EDISON ELECTRIC INSTITUTE BULLETIN

VOLUME II NOVEMBER 1934 NUMBER 11

Floodlighting of Rockefeller Center—photographed from 26th floor of the Graybar Building, New York, by H. W. Wahlquist

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF SEPTEMBER

	1934	1933	%
Kilowatt-hours Generated* (net)			
By Fuel	4,573,851,000	4,193,374,000	+ 9.1
By Water Power	2,188,480,000	2,610,892,000	−16.2
Total Kilowatt-hours generated	6,762,331,000	6,804,266,000	− 0.6
Additions to Supply			
Energy Purchased from Other Sources	146,930,000	212,655,000	−30.9
Net International Imports	75,518,000	70,824,000	+ 6.6
Total	222,448,000	283,479,000	−21.5
Deductions from Supply			
Energy Used in Electric Railway Departments	46,113,000	55,020,000	−16.2
Energy Used in Electric and Other Departments	106,406,000	101,073,000	+ 5.3
Total	152,519,000	156,093,000	− 2.3
Total Energy for Distribution	**6,832,260,000**	**6,931,652,000**	**− 1.4**
Energy Lost in Transmission, Distribution, etc.	**1,058,097,000**	**1,101,594,000**	**− 3.9**
Kilowatt-hours Sold to Ultimate Consumers	**5,774,163,000**	**5,830,058,000**	**− 1.0**
Sales to Ultimate Consumers (kw-hrs)			
Domestic Service	1,023,843,000	940,118,000	+ 8.9
Commercial—Small Light and Power (Retail)	1,110,895,000	1,041,208,000	+ 6.7
Commercial—Large Light and Power (Wholesale)	3,034,140,000	3,253,883,000	− 6.8
Municipal Street Lighting	179,884,000	176,296,000	+ 2.0
Railroads—Street and Interurban	322,715,000	304,138,000	+ 6.1
Railroads—Electrified Steam	54,512,000	54,560,000	− 0.1
Municipal and Miscellaneous	48,174,000	59,855,000	−19.5
Total Sales to Ultimate Consumers	5,774,163,000	5,830,058,000	− 1.0
Total Revenue from Ultimate Consumers	$150,196,400	$146,688,200	+ 2.4

DURING TWELVE MONTHS ENDING SEPTEMBER 30th

Kilowatt-hours Generated* (net)			
By Fuel	53,236,296,000	45,908,534,000	+16.0
By Water Power	29,955,583,000	32,080,337,000	− 6.6
Total Kilowatt-hours Generated	83,191,879,000	77,988,871,000	+ 6.7
Purchased Energy (net)	3,213,947,000	2,799,171,000	+14.8
Energy Used in Electric Railway and Other Departments	1,990,568,000	1,933,597,000	+ 2.9
Total Energy for Distribution	84,415,258,000	78,854,445,000	+ 7.1
Energy Lost in Transmission, Distribution, etc.	**14,550,160,000**	**14,192,874,000**	**+ 2.5**
Kilowatt-hours Sold to Ultimate Consumers	**69,865,098,000**	**64,661,571,000**	**+ 8.0**
Total Revenue from Ultimate Consumers	$1,817,474,500	$1,778,892,100	+ 2.2
Important Factors			
Percent of Energy Generated by Waterpower	36.0%	41.1%	
Average Pounds of Coal per Kilowatt-hour	1.45#	1.46#	
Domestic Service (Residential Use)			
Average Annual Consumption per Customer (kw-hr)	623	603	+ 3.3
Average Revenue per kw-hr (cents)	5.34¢	5.53¢	− 3.4
Average Monthly Bill per Domestic Customer	$2.77	$2.78	− 0.4

BASIC INFORMATION AS OF SEPTEMBER 30th

Generating Capacity (kw)—Steam	23,799,100	24,087,100	
—Water Power	9,005,400	8,975,200	
—Internal Combustion	468,100	461,700	
Total Generating Capacity in Kilowatts	33,272,600	33,524,000	
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(516,595)	(506,071)	
Farms in Western Area (Included with Com'l—Large)	(209,140)	(204,228)	
Domestic Service	20,387,162	19,843,724	
Commercial—Small Light and Power	3,715,430	3,689,204	
Commercial—Large Light and Power	530,119	529,449	
All Other Ultimate Consumers	68,124	64,549	
Total Ultimate Consumers	24,700,835	24,126,926	

*By courtesy of the U. S. Geological Survey with deductions for certain plants not considered Electric Light and Power Enterprises.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume II NOVEMBER, 1934 No. 11

PROBLEMS OF THE INDUSTRY

By THOMAS N. McCARTER
President, Edison Electric Institute

An Address at the 29th Annual Convention of the Empire State Gas & Electric Association, Westchester Country Club, Rye, N. Y., Oct. 15, 1934

In the preparation of my thoughts for this address, I was inclined at the outset to break loose, and to stand up and tell fully just what I really think of all that is going on, not only with regard to our industry but with regard to the policies of our beloved country at the present time. But upon second thought I concluded that I and you all had troubles enough of our own without this morning undertaking to settle all the affairs of the nation on all subjects. I cannot, however, pass by this phase of the situation without expressing the great disappointment that I felt when I listened to the President on the radio on last Sunday night. There was not a word that he said about a return to the gold standard. There was not a word about balancing the budget. There was not a word about the cessation of the prodigal expenditures of the last year and a half. And there was not a word about the Government stopping its competition with private industries of various kinds. I felt at the end of the half hour over the radio as though I had received a cold douche in the face and I didn't know what the future had in store for the country.

Now the attack that has been leveled at our industry—and I am speaking now particularly of the electric industry—in the past one and a half years by various elements of government has been nothing less than colossal. I count myself fortunate that I was here in time to hear a very considerable portion of the admirable address of Judge Caster, and he spoke of the gas industry as compared with the electric industry and said in some respects the gas industry was doing better and in other respects not so well. But in the respects that they are doing better than the electric industry, that is to say, less attacks upon them—the reason is that they are not so prosperous. If equally prosperous, they would be getting theirs just the same way. These attacks, as I say, have been far-reaching and colossal. They really cover three separate and important fields of the industry.

1. The first serious item I want to discuss has been the tremendous increase in taxes assessed by all kinds of governmental agencies upon these electric companies. There was the action a year or so ago transferring the imposition of the Federal 3 per cent tax upon domestic and commercial electric bills from the shoulders of the consumers, where it belongs, if such a tax is to be levied at all, to the treasuries of the companies, simply because the authorities in Washington had it in for the electric companies and wanted to soak them, and that was their way of doing it. In the case of the company over which I preside, which is a large—I don't mean the largest in the country electrically speaking—but a large company, that 3 per cent tax imposed $1,250,000 per annum upon the electric department of our company. And so it went, in greater or less degree, through the whole country. But that wasn't all. All the local governmental agencies of one kind and another have vied with each other to increase taxes upon properties of this kind. Again referring to Public Service Corporation of New Jersey, which is my work—and I refer to it because I am so familiar with it—our taxes, electrically speaking, now reach the enormous sum of $12,000,000 per year out of a gross revenue, again electrically speaking, of some $65,000,000 or $66,000,000. The percentage you can easily figure out. And the total taxes levied upon our aggregation of electric, gas and transportation properties are now about $19,000,000. In the case of the Consolidated Gas properties of New York, the situation is even more acute. There, in one way or another, the taxes have been increased this very year some $9,000,000, and will aggregate during this year approximately $43,000,000. While these various governmental agencies are collecting from the Consolidated property $43,000,000, that company is paying its stockholders of all kinds, preferred and common, an aggregate of some $31,500,000, or just about three-quarters of the taxes they are paying. To my mind that is an impossible state of affairs.

2. Now, secondly, there has come along with this almost universal tendency to increase taxes, a simultaneous demand for the lowering of rates. It seems to me an incredible situation that the public mind should be thus bent when taxes are being raised in the manner that I speak of, not to mention the other costs of operation with which we are so familiar. It is a paradox. The real fact is that this demand for lower rates is absolutely unsound and, so far as there is any demand by the public for it, it is an ignorant demand. They don't know what they are talking about. Perhaps they don't want to. We all know these facts as I realize that I am speaking A-B-C's to an audience that probably knows as much about this subject as I do. Nevertheless I do not think it does us

any harm to take counsel together. Electrically speaking, there are four different kinds of business being carried on by these companies.

First, there is the domestic business. The small resident consumer. They are numerically by far the largest, and that is the class of business about whom the politicians become excited because they have the votes. In my opinion, if there is any class of the electric business in which the rates should be lowered, it is not that class. I think in many instances the domestic rates are now too low.

The second class of business is the commercial business so-called. That is a class of business by itself because it requires the company to keep on hand a large plant capacity to serve this class of business only a short time per day and, in many cases, only a seasonal portion of the year, and because of that fact it is entirely right that they should be put in a class by themselves and pay rates founded upon that fact.

The third class of business is public lighting, which is carried on all over so far as I know at very fair and moderate rates.

And the fourth class is power, the factors of which Judge Caster has very accurately described. That is a competitive business, involving long hours of use practically every day in the year, and they are entitled to a rate competitive with other forms of power.

But the to-do is all about the first class, the domestic customer. Now in our company we have some 690,000, I think it is, domestic customers, and they pay an average rate per month of $2.80 per customer. Less than 10c. per day; less than the cost of a package of cigarettes; less than the cost of a ticket to the movies; and less I am sorry to say, under the New Deal, than the cost of a glass of beer. Doesn't that statement of it show what nonsense the whole thing is? Think of the splendid service being rendered the homes of the country in the manner described by Judge Caster for less than 10c. a day to the average consumer! And yet you would think from what we hear about it, that these great grasping monopolies were grinding down the public by the imposition of monopolistic and unreasonable charges. The whole thing is buncombe—artificially stimulated political buncombe.

Now there has come into being an even more exaggerated piece of nonsense, and that is the agitation for temporary rates. I can't talk about this without becoming incensed. Of all the impudent, unfair, un-American things, that is the worst, and the Governor of New York State, with his banking experience, ought to know better. There they want to decide a case before you have had your day in court. There, upon superficial evidence prepared by some complainant, be he sincere or otherwise, and before the company has had its opportunity for defense, they want to put in a temporary rate. To me it is an unconscionable state of affairs. Happily, in the State of New Jersey, to which your chairman referred, while there has been an effort along that line, it hasn't got there yet, and I don't think it is going to. This is not a political meeting and perhaps it is not a good place for political contrasts, but, in the bosom of the family, I think it is refreshing to read in the morning paper that Mr. Moses, the Republican candidate for Governor of New York, says that this power issue is a fake and that there isn't anything to it, and it ought to be taken out of the campaign.

3. Now the third point of attack upon these companies is the impetus to public ownership arising from certain Federal projects and the financing of municipal undertakings by the Government. The Government of the United States in the last year and a half has committed itself —speaking accurately, the preceding administration committed itself to Boulder Dam, but ignoring that for the moment and putting it in with the others—the Administration at Washington has committed itself to four enormous power undertakings: Boulder Dam, Muscle Shoals, the Northwest properties in the States of Washington and Oregon. Opinions seem to differ as to the total governmental cost of these enterprises. They run up into the hundreds of millions of dollars. Several hundred million dollars have already been spent, and if there be added to these enterprises the St. Lawrence River development, which the Administration seems to have set its heart upon, I do not think it is going too far to say that the Government will have undertaken projects which, before they get through, will cost the taxpayers of this country, one billion dollars. And a very considerable portion of that billion dollars, as I have already shown, will come from us, raised by taxation. It seems to me to be like asking a man who was about to pay the death penalty to turn on the electric switch himself. Could anything be more unfair? Could anything be more outrageous? In all these respective localities there is a far greater abundance of power now existing in the resources already established there than is needed. If these enterprises be carried out, it means ruin to somebody—either to the investors or to the taxpayers, or to both. But the Government isn't stopping there. The Government is lending money on very cheap terms and accompanying it with a gift of approximately one-third of the amount needed, to finance smaller projects in various municipalities of the country, in direct competition with existing enterprises, into which thousands of investors have placed their savings. The whole thing is absolutely contrary, as I see it, to the spirit of the so-called New Deal. Section No. 1 of Title No. 1 of the Industrial Recovery Act, under the head of Declaration of Policy, contains these phrases—stating the object to be to eliminate unfair competitive practices and to promote the fullest possible utilization of the present productive capacity of industry. Well, I'm getting older and perhaps I don't understand the English language as well as I used to. But I can't read anything into that except words which must make the people at Washington put their tongues in their cheeks when they see what they are doing.

We heard a great deal during the last campaign about the Forgotten Man. And I yield to no one in my sympathy for those who are unfortunate; for those who are out of employment. And I recognize the duty upon us all to do what we can to help alleviate the unfortunate condition in which they find themselves as a result of the depression. But what about the 10,000,000 forgotten men and women who own the securities of these companies through the country? What about the 50,000,000 of them, if you pursue it through to savings banks and to life insurance companies and the policyholders of those companies and depositors in the banks—all of whom have an interest pretty acute and pretty direct?

Happily, the situation is arousing the people of the country. I believe it has reached its zenith; and I believe that a strong public sentiment is forming outside of our industry that in time—not right away—but in time will make itself felt upon this question. Many of you have doubtless seen the very remarkable pamphlet prepared by the National Coal Association, which states most admirably what the effect of this will be upon the bituminous coal industry; the effect of the development of all these water powers upon the bituminous coal industry. It

so happens that last spring I had a personal interview with the President, in the course of which he said to me—and parenthetically I want to pay tribute to his perfectly charming and gracious personality. In the course of this interview, he called my attention to the fact that a very serious situation existed in the anthracite coal mining industry in the vicinity of Scranton. He said there were some 50,000 miners in that locality who were unemployed, and that on the basis of four to a family, that created a condition of social unrest involving 200,000 people, and that he had it in his mind that the electrical industry could be of considerable help in alleviating this trouble by henceforth building their stations for increased output near the mouth of those mines, thus affording employment to the people in whose interest he was speaking, and then transmitting the energy over wires rather than the coal over railroads to the seaboard. I told him that I thought it was an old story; that I wasn't particularly up-to-date upon it, but I would get all the facts for him and let him know what they were. I did so. I put competent engineers upon it and made a report to the President, which shows that economically and practically there was nothing in that proposition. What is the use of sitting up nights to find a way to give 50,000 anthracite miners work if you are doing something with the other hand to put an equal or larger number of bituminous coal miners out of a job? I think his solicitude for the anthracite miners is at complete variance with his attitude in supporting these hydro-electric projects, which will have the effect of bringing the result which the National Coal Association has so ably stated.

There are forming in various parts of the country several associations having for their purpose the protection of investors. But it is a big job to corral the necessary help from such a scattered army of people. And for obvious reasons it is not desirable or practical for the utility companies to directly contribute to the support of these enterprises. But the time may come when even that will have to be done whether they like it or not.

So I say, over this long period of one and a half years, we have been thus shot at from these three angles, and the reaction upon my mind is—What a splendidly sound foundation the industry must have been on to stand it! Such attacks leveled against most any other industry in the country would seem to me to have driven it out of business. As I have tried to show the terrible part of it all from the standpoint of the companies, I can't help wondering why they pick on us, as has been so splendidly set forth by David Lawrence in some of the editorials which he has published in his Washington paper. Why do they pick on us and let food, fuel and clothing alone? Those who oppose our rates and attack us in all these ways could with a great deal more force of propriety attack many other forms of business. Statistical figures show that the gas and electric expenditures by the average family aggregate 1.67 per cent of the family budget, and that, sub-divided between gas and electricity, is about 1 per cent for electricity and two-thirds of 1 per cent for gas. When you get into food and clothing and those things you get 30 per cent and 12 per cent. But we are the targets against which they shoot, for political and demagogic reasons.

Now I have, and always want to have, respect for the Government of my country and the Government of my state, and for those who administer these respective positions. It has been thought wise, and perhaps it was, for the electric industry as a whole not to be too active in the past year and a half. I am not so sure that the policy has justified itself, because we haven't accomplished a great deal with our silence. But whatever may have been the right of this policy for one and a half years, that has gone over the dam. The question is as to the future. The National Coal Association is getting ready to fight. The Southern States Industrial Council has commenced to fight. It is publishing a very strong pamphlet, and its president has addressed an open letter to the President on this subject of Government competition with business—not only our business, but down there the Government is manufacturing furniture, mattresses, and what not. I do not believe in any policy of what is vaguely called propaganda, but I do believe that the time has come to stand up and be counted. I do believe that self-preservation is the first law of nature. I appreciate that whatever is done must be done in a polite and dignified manner. But so far as any influence that I may have with the Edison Electric Institute, of which I am temporarily the president, I propose a vigorous defense from now on and a demand for simple justice.

PRESIDENT McCARTER ON THE PRIZE AWARDS

Announcements of the several prizes for 1935, to be administered by the Edison Electric Institute, have been made in the BULLETIN and through a poster and booklet prepared for use by member company organizations. The prizes, made possible by the interest and generosity of several donors, are designed to stimulate interest and research in various fields of electric utility operation, or as rewards carrying distinctive honors for unusually meritorious accomplishments.

For a number of years the administration of these or similar prizes has been an important duty of the Institute and its predecessor organization. Interest in the awards has increased from year to year and the awards to individuals for papers on specified subjects are now very generally esteemed as of great value in stimulating constructive thought, investigation and expression by those engaged in this industry, and the prizes are highly regarded by their winners as tokens of recognition and appreciation for their work.

The majority of the entries in the competitions of past years have been of practical value to the industry, and many of the prize-winning papers stand as contributions of permanent value to public utility literature.

The prizes announced for individuals include the Byllesby Prize for papers on accounting subjects, the Lindemann Prize for papers on electric cookery, the Forbes Prize for papers on public relations and the McGraw Prize for papers on engineering subjects. The prizes to companies and individuals for accomplishments in specified activities are: the Charles A. Coffin Award for "distinguished contribution to the development of electric light and power for the convenience and well-being of the public and the benefit of the industry"; the Hughes Award for "the greatest contribution to the development of the Domestic Electric Cookery Load"; and the Martin Award for "the greatest contribution to the advancement of Rural Electrification during the year 1934."

The latter group of awards has an especial appeal to management and I am hopeful that all organizations that have made excellent gains in the fields covered by the prizes will submit exhibits.

Competition by employees for the prizes offered to individuals deserves the encouragement of our executives, and such cooperation as can be given the Prize Awards Committee, Mr. Frank W. Smith, Chairman, in publicizing the awards will be very helpful.—THOMAS N. McCARTER.

PRIZES

to be administered by the

EDISON ELECTRIC INSTITUTE

AND AWARDED IN 1935

PRIZES TO INDIVIDUALS

For Papers on Subjects Relating to the Electric Light and Power Industry

BYLLESBY PRIZE . . . . . *Accounting*

Cash prizes of $100, $50 and $25 donated by Byllesby Engineering and Management Corporation, in memory of Colonel H. M. Byllesby, for the three most meritorious papers on any Accounting subject relating to the Electric Light and Power Industry.

FORBES PRIZE . . . . . *Public Relations*

A cash award of $250 donated by Mr. B. C. Forbes, Editor, Forbes Magazine, for the most meritorious paper dealing with the subject of Public Relations in the Electric Light and Power Industry.

LINDEMANN PRIZE . . . *Electric Cookery*

Cash prizes of $150, $100 and $50 donated by Mr. A. L. Lindemann, Vice President and General Manager, A. J. Lindemann and Hoverson Company, for the three most meritorious papers dealing with the Advantages of Electric Cookery for Domestic Purposes.

McGRAW PRIZE . . . . . *Engineering*

Cash prizes of $250, $150 and $100 donated by Mr. James H. McGraw, Chairman of Board, McGraw-Hill Publishing Company, for the three most meritorious papers on any Engineering or Technical subject relating to the Electric Light and Power Industry.

RULES AND CONDITIONS OF CONTESTS FOR PRIZES TO INDIVIDUALS

Any person employed by a company having membership in the Edison Electric Institute is eligible to enter the competition. No person is eligible to win two years in succession the identical prize or lower prize of the same award, but is eligible for a higher prize of that award. Papers must be the original work of the author or authors, prepared exclusively for this competition. Papers may be of any length, and pen-and-ink drawings or photographs suitable for reproduction may be included. Papers should be typewritten on one side only.

Papers will not be returned to contestants, but will become the property of the Edison Electric Institute and will be available for inspection at the General Offices of the Institute. The right is reserved to publish any paper entered in the contest.

The first page of the manuscript must give the following information: the name of the prize for which the paper is submitted, title of paper, name of author, name and address of employing company, title or character of position and home address. One paper may not be submitted for more than one prize.

PAPERS FOR ABOVE PRIZES MUST BE FORWARDED BY MARCH 1, 1935

PRIZES TO COMPANIES AND INDIVIDUALS

For Accomplishments in Specified Activities

CHARLES A. COFFIN AWARD

Sponsored by the General Electric Company

A Gold Medal, known as the Charles A. Coffin Medal, will be awarded to the public utility operating company within the United States which, during the year 1934, has made a distinguished contribution to the development of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company awarded the medal will also receive $1,000 for its employes' benefit or similar fund.

HUGHES AWARD

Domestic Electric Cookery Load

A cup donated by Mr. George A. Hughes, President, Edison General Electric Appliance Company, Inc., to the Company Member of the Edison Electric Institute showing the greatest contribution to the development of the Domestic Electric Cookery Load, through promotion, or selling, or both, during the twelve month period ending February 28, 1935, and cash prizes totaling $1,000 to the individuals responsible for the achievement.

MARTIN AWARD

Rural Electrification

A bronze plaque donated by Mr. Thomas W Martin, President, Alabama Power Company, to the Company Member of the Edison Electric Institute showing the greatest contribution to the advancement of Rural Electrification (agricultural advancement within the company's territory due to uses of electricity, development of rural load, cooperation with other agencies, extension of rural lines, organization and plan for conducting rural electric development) during the year 1934.

IMPORTANT—Complete details and registration forms for the Charles A. Coffin Award, the George A. Hughes Award, and the Thomas W. Martin Award should be secured from the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

Elaborate and costly exhibits are unnecessary. The merit of the enterprise presented in papers or exhibits will be the prime factor in determining awards, without regard to the size of competing companies.

PRESENTATIONS OF ACCOMPLISHMENTS MUST BE FORWARDED BY APRIL 1, 1935

Papers and exhibits for 1935 prizes should be addressed to the Secretary, Edison Electric Institute, 420 Lexington Avenue, New York, N. Y. Winners will be announced and prizes awarded at the 1935 Convention of the Edison Electric Institute

PRIZE AWARDS COMMITTEE: Thomas N. McCarter, James E. Davidson, Frank W. Smith, *Chairman*, M. T. Chandler, *Secretary*

GO TO THE PEOPLE

By FRANK McLAUGHLIN
President, Puget Sound Power & Light Company

"With public sentiment nothing can fail, without it nothing can succeed." . . . ABRAHAM LINCOLN.

It is my belief that in these words of wisdom from the immortal Lincoln is the challenge of the hour to the light and power companies of this country—a challenge to them to go to the people with their story and to tell it in a frank and vigorous, yet friendly manner, laying all the cards on the table. By this I don't mean that we should do a lot of bragging or apologizing or crying for sympathy; I mean that we should let people know that there are two sides to the so-called power question. If we don't give the people honest-to-goodness facts, tell them the truth about our business, who will?

If we can't justify our place in the scheme of things on the basis of results achieved in advancing human welfare and on our ability to further contribute to the common good, our day is done and we should be the first to recognize it. We are assured of a place in the sun only on the merits of our performance in discharging to the satisfaction of all concerned the obligations of a public trust. We must not only do a good job but our customers must recognize it and feel that we are capable of rendering a better service at a lower cost than can be otherwise obtained. Unless this results, it is inevitable that somebody else will take our place.

We can't beat the radical politician at his own game—we must be intellectually honest—we must fight untruth with truth—we can't dip into the taxpayers' pocket for subsidies for any losses we may incur—we can't raid the public treasury—the shoe is on the other foot. But we too can go to the people with our story. This is the American and democratic way of deciding questions of public import.

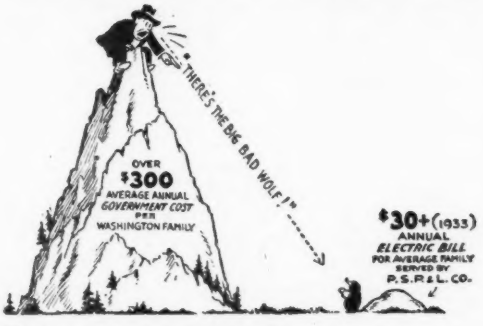
These may be dog days for the light and power companies and I think you will agree that we are in the doghouse, but it will be just too bad if they are also pussyfoot days. In the words of the racketeer (a term frequently applied to those in the power business, but seldom deserved), the light and power companies are "on the spot." We are on trial—at times it seems on trial for our very existence and that the death penalty is about to be imposed without a fair and just trial. The public, however, is the jury, the final court of appeal; our case must be argued before them; in their hands rests our fate.

The prosecution is represented by able persecutors—by yellow journalists and self-seeking politicians who, whenever it serves their purpose, seem to delight in making innocent people appear guilty, all the while presuming to protect the rights of the people, but in reality they are dominant factors in destroying those rights. Our enemies are adept at throwing banana peels in our path, hoping we will slip on them and break our necks; they are constantly sniping at us from the ambush of special privilege. The charges against us are for the most part wild, extravagant denunciations of the many because of the shortcomings and guilt of the few.

And what of the jury? Day after day through the press, radio and from the soapbox, the crackerbox and the cellar the people are being bombarded with stories of the wicked and evil doings of that great public menace, "The Power Trust." Ridiculous though it is, the people are led to believe that the power companies are responsible for many of the nation's social and economic ills and that the remedy, the great "cure-all," is "public power." The people's minds have become inflamed and prejudiced through the incessant rantings and ravings of demagogues, reciting tales of wholesale robberies of widows and orphans through sale of watered stock, of the mulcting of the public through high rates based on this watered stock, of nefarious political activity, of tax dodging, of insidious propaganda and whatnot. We are continuously being splashed with mud and showered with abuse. By such goings on the power companies are built up in the people's minds as Public Enemy No. 1 (now that most of the leading gangsters have been put out of circulation).

Now, are we going to be content to let those who would like to see our operations crushed and supplanted with public ownership tell our story for us—and at the

MOUNTAIN *and* MOLE HILL!


"THERE'S THE BIG BAD WOLF!"
OVER $300 AVERAGE ANNUAL GOVERNMENT COST PER WASHINGTON FAMILY
$30+(1933) ANNUAL ELECTRIC BILL FOR AVERAGE FAMILY SERVED BY P.S.P.&L. CO.

THE big opportunities for saving people's money are in reductions in the cost of government. Compared with government costs the home electric bill is a mole-hill alongside a mountain. The average domestic customer of the Puget Sound Power & Light Company pays eight and one-half cents a day for electricity; it costs the average Washington family almost a dollar a day for government. According to United States Census figures, State and local general property taxes in Washington INCREASED 96% from 1912 to 1932. During this same period, the cost of electricity per kilowatt hour to our home and farm customers DECREASED 70%.

Hasn't the time come to worry a lot more about taxes and less over electric rates?

Frank McLaughlin
PRESIDENT

PUGET SOUND POWER & LIGHT COMPANY

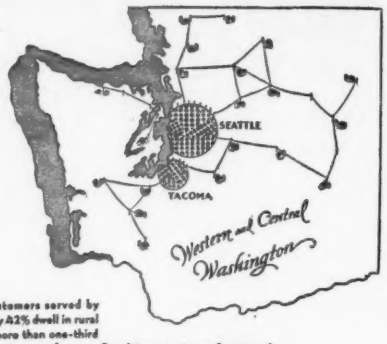
WE have talked often about the tremendous tax burden of this company because it's something big enough to talk about, and it vitally concerns you. We have shown what a factor the company's taxes are in supporting schools, city, county, state and other forms of government. But let us visualize for your benefit what our 1934 taxes really mean. The total we are called upon to pay is now placed at $2,000,000. This is $5,479.45 for every day in the year. As the hour hand moves from 2 o'clock to 3 o'clock this afternoon, and every other hour in the march of time, $228.31 is added to the cumulative figures—one hour's tax. The minute hand ticks off $3.80 every 60 seconds, night and day. In the face of such tax burdens isn't it remarkable that our domestic customers today pay on the average less than a third as much per kilowatt hour as they did in 1913?

Who will wind the clock if we are gone?

Frank M Faughlen
PRESIDENT

PUGET SOUND POWER & LIGHT COMPANY

SERVING AND BUILDING AN EMPIRE!



OF the customers served by this company 42% dwell in rural areas, and more than one-third of this percentage are farmers. Supplying a territory of scattered homes, and farms here and there, is an entirely different and more expensive proposition than serving a compact, closely built-up city where the houses are piled row on row. For instance, the number of customers per square mile of territory served by the Seattle and Tacoma municipal plants is about thirty times greater than for the Puget Sound Power & Light Company, and likewise the income per square mile of territory served runs in the same ratio. This, of course, has a very important bearing on rates. Further, taxes take an average of $11.00 annually per customer from this company's income.

Electrified rural areas help build cities

Frank M Faughlen
PRESIDENT

PUGET SOUND POWER & LIGHT COMPANY

same time do a lot of story telling about it? Our enemies would, I am sure, be delighted if we followed such a course—it's water on their wheel—they would like to write our epitaph. If we don't speak right out in meeting and tell our story ourselves the inference will be that we haven't got a good story to tell. Having a good story to tell, why shouldn' we tell it? What harm can it do? Are we going to throw up our hands and meekly surrender to the crackpots and political bandits? Isn't it our job to dig our baby out of the mud? Again, how is the jury to make an intelligent, fair decision unless we present our case in strong, convincing terms? It's no secret that the confidence of people in the light and power companies has been shaken. There is too much of a prevalent belief that we have failed in the trust imposed upon us. It is our fault if we do not correct public thinking so that it conforms with truth. In a broader sense, and, apart from the motive of self-preservation, if we do not do so it means that politicians will lead the American people still deeper into the morass of governmental domination and will still further restrict individual rights and liberties.

You just can't laugh off the attacks being made on us these days; they are too cancerous, especially so in view of the present disturbed and troubled minds of the American people who seem to believe that there is merit in change regardless of the merits of the change. Admittedly our job is a tough one—we have no sugar-coated pills to pass out—we can't peddle bunk—we must tell the people to forget the bunk and face the facts.

In all the welter of denunciation and recrimination it sometimes seems incredible that such bitterness as has been planted by the demagogue in the public mind can be overcome and the motives behind such unfair political propaganda understood by the people. Whipped up, as he is, by the demagogue to a state bordering on hysteria through stirring appeals to passion and prejudice, one may naturally wonder whether the common sense and fairmindedness inherent in the average citizen will respond to sound argument and in the end prevail. Like any of the rest of us, his emotions sometimes get the better of his reasoning and he goes balloon chasing, but I feel that when the final test comes his feet will be on the ground. I believe that the great majority of people want to do the right thing. While self-interest naturally predominates, Americans want such facts as will enable them to come to an intelligent and just decision in the light of their own welfare. I don't believe they will cut off their nose to spite their face. True, the ballyhoo of public power and its magic healing properties are alluring and any "something for nothing" program is enticing in these difficult times, but I firmly believe that the people when they know the whole truth will want to give us a square deal, an even break.

. . . . . .

Anyhow, this is the premise on which, through the press, we have gone to the man on the street with a series of discussions of our mutual problems and have talked with him in his own language, just as if he were sitting across the table in our office. There has been nothing stilted, nothing high hat about these talks. We have tried to reduce the mechanics and problems of our business to the simplest of terms and to tear away the veil of mystery and intrigue with which the demagogue has clothed our activities. We have endeavored to get over the fact that our business is run by human beings, that we are no better or no worse than the people in other walks of business or professional life—or in politics. It would be extraordinary if some bad eggs didn't show up in the power business. By the same token, all of those who have sinned against their fellow men—who have betrayed their

public trust—are not in the power business.

I for one am perfectly willing to put our balance sheet of pluses and minuses as to what we have achieved in the public interest alongside of the scoreboards of those who run governments or other businesses. The great good which the power companies have accomplished in making electricity available over wide areas at low cost has been buried in the public mind by the sins of the few and the tirades of abuse heaped upon the many.

In these letters we have told the people frankly that we have not been without fault—that we were rectifying our mistakes; and to the extent necessary to fully protect the public that we should reform ourselves or be reformed, but that crucifying us was not the answer. We have stated that we were for sound regulation which would safeguard the rights of customer, investor and employee. We have told of our tax burdens and their effect on rates—we have talked much of government in business, of the unfair competition of untaxed and unregulated governmental agencies in the power business. We have emphasized the plight of our investors whose vision, courage and money blazed the trails of electrical development when all the demagogue knew about electricity was that it was something to be afraid of. We have said that if the use of a natural resource was a controlling argument for public power, why not public bread, public milk, public clothes, public eggs, public coal, public lumber, public oil, and so on. We have also pointed out that to a greater or lesser degree today all business is in the same boat and confronted with an ever-increasing dose of government in business; that if unfair governmental competition destroys the light and power companies, then unfair governmental competition can destroy any other industry in precisely the same manner.

MR. McLAUGHLIN

On this and preceding pages are shown examples of the letter-advertisements discussed by Mr. McLaughlin.

In short, our approach to the discussion of the so-called "power issue" has been that its proper solution depended upon fundamentals, facts and sound principles rather than upon mud-slinging and ballyhoo, upon economics rather than politics. We have pointed out that power has long been a political football in this State, much too long, in fact, for the good of everybody concerned; that the time has arrived when the people should get down to brass tacks and do some sober thinking and sound acting about the power question; that they ought to give their passions and preju-

DO TAXES BOOST RATES ?
ELECTRIC RATES
TAXES
IT HAS BEEN STATED that power from the Grand Coulee development will cost around two mills per kilowatt hour. This project which will not pay any taxes is being built with taxpayers' money. The taxes alone which this company pays amount to almost 3 mills per kilowatt hour. Just think of that—rather staggering, isn't it? If we did not have to pay any taxes on our light and power operations and the savings were credited against income from domestic and farm customers, rates for these classes of service could be reduced at least one-third. Utilities operated by a governmental agency should be taxed as we are taxed. Anything else is unfair competition and a government should not sponsor unfair competition.
This company should not be heavily taxed to subsidize municipal or other governmental operations
Frank M Laughlin
PRESIDENT
PUGET SOUND POWER & LIGHT COMPANY

A BIGGER SLICE FROM A SMALLER PIE
TAX EATER
TAXES-$2,000,000
15.4%
TOTAL EARNINGS-1934 $13,000,000
TAXES-$1,395,630
11.4%
TOTAL EARNINGS 1933 $12,599,280
TAXES-$1,086,978
8%
TOTAL EARNINGS-1932 $13,549,978
TAXES-$1,011,987
6.4%
TOTAL EARNINGS-1931 $15,765,898
TAXES-$855,086
5%
TOTAL EARNINGS-1930 $17,056,348
THE TAXES of this company for 1934 will amount to around $2,000,000—more than double what they were in 1930. This, I know you will agree, is a tremendous jump, especially so when it is realized that our gross income during this period has not only not increased, but has decreased in the large sum of $4,000,000. There are no plums left in the pie, the taxeater has gotten the crust—he's scraping the plate. You can't pay taxes from deficits; you can't get milk from a dry cow. The time has surely arrived when you folks, in the interest of your own pocketbooks, should do some sober thinking and real figuring about POWER and TAXES.
Frank M Laughlin
PRESIDENT
ASK YOURSELF who will pay this Company's taxes if it is put out of business?
PUGET SOUND POWER & LIGHT COMPANY

dices a back seat and tear away the smoke screens of self-seeking politicians; that the power issue was greatly overdone and that so-called "cheap power" made available by dipping into the taxpayer's pocket was no cure-all for our multitudinous present-day problems. We have asked the people to be rational and not fanatical on this power issue; to find out for themselves whether the private utilities are worthwhile or a public menace; to strip public ownership of its subsidies and see how it looks; to sit down and calmly and judiciously figure out what was the right and proper thing to do in their own best interests. We have tried to convince the people that on their own account this so-called power issue should be settled on its merits; that they should know the full story as to the advantages and disadvantages of private operation and the pluses and minuses of public operation; that there was nothing in the record to indicate that public ownership was best for the people and that before they succumbed to the ballyhoo of the "public power Pied Pipers" of modern times they should get all the facts and figures of both private and public operation. We have also pointed out that the only way a fair comparison could be obtained was to put both operations on a comparable basis—each subject to the same searching inquiries, the same taxes, same regulatory laws and expenses, and so on.

Naturally you ask, has it been worth while? Have these letter talks done some real good? Do people read them or are they just passed up with the comment, "More Power Trust Propaganda"? Of course, a lot of people didn't read all the letters, but the indications are that a great many people have read a number of them. This information has come from numerous and varied sources and from people in all walks of life. Without question, many people in the State of Washington know much more about the fundamentals of the power business and of our mutual problems than would have been the case if we hadn't frankly talked about them. Our stockholders have been enlightened by our discussions—our employees have been encouraged and pleased that we were vigorously presenting our side of the story and fighting for our place in the sun, and those who are for private ownership have been given the necessary ammunition to support their belief. The mere fact that we have gone to the people with our story has tended to allay suspicion and engender confidence.

We have ample proof that our enemies as well as our friends have at least read some of the letters. My own belief is that demagogues, radicals and public ownership adherents have carefully followed the whole series, which has run for about a year. In the press, over the radio and in public appearances they have referred to the letters, often, it is true, in uncomplimentary terms, and have attempted to belittle the arguments presented therein, but the big thing to me has been that they felt the letters were worth recognizing and talking about. The more they talk about them, the better I like it; they at least can get from the letters the up-to-date facts about this company and they don't have to use warped and garbled ancient history or fabrics of a destructive imagination. Furthermore, they must feel that the letters are effective in moulding public opinion or they wouldn't be so anxious to discredit them.

Just recently a United States Senator from this State referred to me in a sarcastic way as a pretty letter writer and told his audience to ask me why I didn't use the money that I was spending on these letters for dividends to stockholders. I should be glad to have the crowd ask me to answer the Senator's question. I would tell them how little it costs and that it is money well spent in giving the real facts about this company and that our stockholders would benefit greatly if the Senator would use them.

Just as an interesting sidelight; in my visits to various communities served by the company, upon being introduced to folks a number have stated: "I feel as though I know you; I read your letters." Here are some typical excerpts from a great many communications I have received from every stratum of the public in this State:

"The most constructive letters I've ever read any time, any place," said a grocer, "they ring true, are full of common sense, and are bound to appeal." "You are making many friends," declared an asbestos supply house man, "we hope you continue to fight the propaganda that has been soaked up in this territory for many long years." "You set forth the basic economics that must be recognized in all fields," asserted a fuel dealer, "and you are doing a good work, not only for your own company but for all industries."

A shoe repairman in Seattle, where we have municipal competition, signed a 10-year power contract with the company; he said the letters had persuaded him to deal with the privately owned company.

"Your letters will be productive of good results," said an investment broker. "The information contained in your letters should have been dashed in the face of the public 10 years ago," asserted an insurance executive. "Don't be too tactful," he advised, "call a spade a spade." A fruit packer wrote, "I have followed the letters with interest; more power to them."

While these advertisements are serious in purpose, they have a lighter touch in the interpretive cartoon, through which we have tried to tell the story in picture more quickly than words could do. It is the aim of these cartoons to leave the reader with a smile, but also something to think about. Then, too, each message carries a short sentence boxed off from the main text which seeks to put the story in a nutshell.

In supplementing our newspaper advertisements, we carry similar messages on our outdoor bulletins and tie in our radio programs so that the same theme may be dominant in all of our contacts with the people. Reproductions of newspaper messages are framed and placed in our offices and stores so that they may be seen by our customers.

To appraise in dollars and cents the value of such a program of publicity is difficult. If we reverse the picture and ask ourselves the cost of not doing so, of letting the attacks on us go unanswered, of not telling our story, I fear that the cost would be a tremendous one. Confidence of the people in the power companies is today being undermined by false propaganda and unjust attacks. Under such conditions are we not remiss in our duty if we do not give the people such information and facts as will enable them to think and act wisely in their own best interests on this all-important power question? Surely we can't let the difficulties of the task and our present unpopularity keep us from discharging to the best of our ability the obligations of a public trust. Certainly, we do not want to lose the game by default. This is no time to exhibit an inferiority complex or to assume that yell leaders win football games.

We have got to merit the confidence of the people or we won't get it. It is our most precious possession. In my opinion, failure to accept the challenge to go to the people with our story is just plain suicide.

Full Speed Ahead!

SALES COMMITTEE VIGOROUSLY ATTACKS LOAD BUILDING PROBLEMS

By C. E. GREENWOOD
Commercial Director, E.E.I.

At the call of Chairman H. P. J. Steinmetz, the Sales Committee met at the Palmer House, Chicago, on October 19th to perfect its organization and discuss Committee plans and progress. Reports of subcommittee chairmen were presented together with reports of the national, sustained, promotional programs being operated by the Institute jointly with manufacturers.

Better Light-Better Sight

M. E. Skinner, Chairman of the Better Light-Better Sight Bureau, discussed at length a change in the Lighting Program this year, and its expansion to include numerous other associations. He especially commended the aggressive and effective cooperation of the Better Vision Institute which has introduced the influence of light on vision in all its promotional activities. The paint groups are also actively participating as well as the National Retail Dry Goods Association. The latter has sent out Lamp Selection Guides which were prepared by the Bureau and widely distributed through utility and manufacturer channels.

The I.E.S. Study Lamps have met with immediate success. These have been developed rapidly and there is better cooperating among the lighting equipment groups. The new idea in lamp selling is *"a lamp to see by."* The severe lines which were prevalent in the early products of the portable lamp manufacturers are giving way to lamps with greater style value. There will be a complete line of these Better Sight Lamps for the home. A booklet prepared by the Bureau, "How to Sell the New Study Lamps," has been addressed to the lamp buyers and is having wide distribution. Since these lamps are not to be sold on price, but on effective illumination, a special selling job must be done here.

A feature of the promotional work of the Bureau for early 1935 will be a Commercial and Industrial Lighting Campaign. The November issue of *Better Light-Better Sight News* will announce this special concentration. Three booklets will be issued in connection with the campaign, one a Plan Book including the possibilities, and suggestions for organization and selling. A second booklet will cover lighting standards, lighting intensities, demonstration material and information on the science of seeing and selling. The third booklet will contain standards and specifications for lighting equipment.

It is amazing to find the widespread activity throughout the United States by utilities and other interested groups in the Better Light-Better Sight Program. This being a sustained program, and the work being of a permanent nature, new employees are being added rapidly to the Lighting Departments of utilities. Latest reports show that regular Lighting Departments are being organized where none existed a year ago, and a "GE" survey among leading utilities indicates that there are three thousand lighting men and women now devoting their time to lighting where less than five hundred were on the job last year.

The larger utilities are leaving no stone unturned to make the Lighting Program effective in all fields of endeavor. In this connection the writer would cite as an example the Public Service Electric & Gas Company of Newark, N. J. This company is serving 222 municipalities having a population of over three million. There are thirty-one illuminating engineers scattered through the twenty-four district offices, all supervised by a general Lighting Representative. A Better Light-Better Sight Bureau is to be organized by every one of the district offices, all of which will act under an Executive Committee which will be the active working group. It is interesting to note that these local Bureaus will tie in with the local activity of the Better Housing Program. One thousand Better Light-Better Sight emblems have been distributed through optometrists, contractors, lighting equipment dealers and others.

To show that this utility will reach into every potential field for productive results, some of the lighting activities planned are listed as follows:

School Lighting—Pamphlets on school lighting distributed to the members of the various boards of education in the territories served.

Doctors' Offices—A list of 4000 M.D.'s has been prepared and an extensive effort will be made to demonstrate correct lighting in each office.

Store Lighting—A list of 20,000 names has been prepared for show window activity with direct-by-mail material and personal follow-up.

Industrial Lighting—A mailing list of 5000 has been prepared, each to receive four illustrated industrial lighting letters followed by calls.

Church Lighting—During November, 1500 churches will receive direct-by-mail material.

Commercial Christmas Lighting—10,000 folders are to be distributed to merchants during the first part of December.

Residential Christmas Lighting—Also in early December there will be 25,000 illustrated folders sent to a list of selected residential customers covering the subject of decorating the home for Christmas holidays.

Residence Lighting—Additional work in the residence lighting field will be distribution of 52,000 booklets on "How to Light Your Home" and on "Seeing." There will be other folders distributed on better lighting, and 100,000 lighting measuring tapes.

Mazda Lamp Campaign—October was employees' Mazda Lamp Month with a quota set of 453,000. The quota had been exceeded on the 24th of the month.

General—A series of newspaper advertisements on better lighting is being run in 21 daily newspapers. This does not include the special series to promote the sale of I.E.S. Study Lamps. Numerous lectures on Lighting and on the Science of Seeing are now being given and scheduled before electrical groups, rotary groups, parent-teacher associations, schools and other sources interested in this great educational program.

Many other companies are equally aggressive, and the Better Light-Better Sight Bureau expects to place more of this information before the industry for information and guidance.

Chairman Skinner has found the demands on his time for this comprehensive program so great that he has been obliged

to resign as Chairman of the Lighting Sales Subcommittee. Julius Daniels, Edison Electric Illuminating Company of Boston, well known in the lighting field, will be Chairman of the Subcommittee. Mr. Daniels briefly outlined what he hoped his Committee could accomplish in fostering interest in the Better Light-Better Sight Program and the general stimulation of our industry in the promotion of better lighting.

Wiring

J. D. Noyes, reporting for the Wiring Committee, announced that for the present the sales aspects of wiring would be subordinated to the more immediate demands of tackling certain larger problems of wiring on which sales promotion depends. These Mr. Noyes discussed at length under the heading of wiring reform, which includes the simplified new entrance service in which the meter is ahead of the switch, and the more generally accepted use of service entrance cable. It was brought out that several manufacturers were working on the development of improved surface wiring methods.

Mr. Noyes has assigned the development of detailed specification for wiring to a special committee headed by E. A. Brand of Niagara Hudson Power Corporation, Buffalo, who now has the subject under advisement.

Efforts will be made by the Wiring Committee to gain in the National Electrical Code more sympathetic viewpoints to the needs of the utility. Reference was made to the recent statement in *Electric Light & Power* that in over thirty companies the cost was $50 for entrance service and wiring an electric range. Mr. Noyes brought out that range wiring can be done satisfactorily at a price of $22 in Detroit. It was the sense of the meeting that the complications of the Code have reached a point that it is a very definite handicap to the promotion of sales and the ultimate lowering of rates.

Air-Conditioning Committee

In the absence of Chairman C. E. Michel of St. Louis, E. A. Freund reported on what had been done in the air conditioning field during the past year. There has been broad demand for the report of Mr. Michel's Committee of last year, which is the most comprehensive report that has been published on Air Conditioning. The report gives practical information designed to aid utility companies in the promotion of an increased use of Air Conditioning.*

* E. E. I. Publication B2.

Further factual data which will help salesmen give more specific information on costs will be collected together with information on promotional and sales campaigns which have been operated by the light and power companies.

While last year's report covered what has been done in the Air-conditioning field, the next report of the Institute's Committee will emphasize what can be done in furthering the Air-conditioning industry. It is expected the report will approach such subjects as the financing of Air-conditioning units and the promotional value of the formation of local Air-conditioning Bureaus and the holding of exhibits. The development of films is likewise under discussion.

The utility industry views with optimism the possibilities for the sale of equipment and load building in the domestic, commercial and industrial fields.

Industrial Power

The work of the Industrial Power and Heating Subcommittee under Chairman W. H. Sammis has been progressively and constructively active. Mr. Sammis held a meeting of his Committee at Chicago on October 18th, took inventory of accomplishment and scheduled further activities. There have previously been issued by the Committee two bulletins on gas and oil pipe line pumping which adequately cover the present situation. Competitive fuels were discussed. Mr. Sammis brought out that articles had been prepared on the subject of commercial cooking which have been published in such trade journals as *Hospital Management, American Restaurant,* and others. The present bibliography on commercial cooking data is to be brought up to date. In discussion of the further growth of the commercial cooking load it was brought out that one man at least should be assigned to every 7500 commercial customers. Where this has been done there has been a most satisfactory return on the investment in man power.

A report on hotel and office building competition is in the making.

Pursuing his report on the deliberations of the Committee, Mr. Sammis outlined the check-up to be made on general sales aids; the general study of competition and a study of power inter-connection contracts.

Power Transmission

At the request of Chairman Steinmetz of the Sales Committee, Mr. F. H. Willard, President of Graton & Knight Co., Worcester, Mass., and representing the Mechanical Power Engineering Associates, appeared before the Committee to discuss M.P.E.A. advertising program on power transmission equipment. Mr. Willard outlined the case studies in 15 to 20 plants in which information was obtained on power transmission and the needs of those particular industries, and what might be done for more economical operation. He stated that Power Transmission Clubs had been organized in different sections of the country to study the common problems of interested groups.

Mr. Willard exhibited a series of advertisements that will be run in the trade press, and discussed the plans of the M.P.E.A. for setting up the mechanical use of electric current through suitable transmission arrangements.

The purpose of Mr. Willard's presentation was informative and request was made for cooperation of the power interests for mutual benefits to be derived.

Electric Water Systems Council

The First Concentration in the sustained program on Running Water has ended, but there has not yet been time to appraise the results. A large number of utility companies distributed broadsides. In some sections the results have been gratifying. What cannot be evaluated are the advantages of utility and pump dealer coordination in this promotional effort. Many rural and semi-rural homes have been benefited by the installation of an electric water system which makes a contribution to better living conditions. The slogan, *Running Water—Your Family Deserves It,* is known in many a rural community.

P. H. Powers, Chairman of the Electric Water Systems Council, reported that he has scheduled a meeting for November 14th at Cleveland where further details of the general plan for the continuation of the Program during 1935 will be discussed.

Mr. Powers is also serving the Institute as Chairman of the Rural Sales Committee. The efforts of this Committee to promote rural sales development are known to readers of the BULLETIN. A feature of the work of the Committee is a bi-monthly publication—*Rural Electrification Exchange*—edited by F. A. Belden of the Boston Edison Company. It was announced that the Committee would continue to foster interest in rural sales development through the publication of this news medium.

Table Cookery Program

It has been understood with the domestic appliance manufacturers who joined

with the Institute in the promotion of electric tableware that a medium of information would be published for at least six months. Stimulation of the small appliance business has been widespread and scores of utility companies have participated in the promotion or selling or both of table cooking devices used in the kitchen and dining room in particular. There has been an urge to continue the Program through 1935. Plans are now under advisement for the monthly publication of *Table Cookery Topics* and a national contest for dealers of different classes for the most productive achievements in selling. Later announcement will be made as plans are completed.

Residential Sales Committee

In the absence of Chairman D. M. DeBard, it was reported that the Residential Sales Committee this year would devote its attention to the broad problems underlying residential load building which is a major effort of the industry. Rental and rental-purchase plans have been studied, both advantages and disadvantages. This appears to be a satisfactory method for the more rapid building of the cooking and water heating load, and applications of this widely used English practice may gain in popularity here.

It is hoped to arrange an exchange of ideas and sales plans. Mr. DeBard will hold an early meeting of his Committee.

The Electric Kitchen

With the objectives in mind of directing public interest in the All-Electric Kitchen, and aiding the Recovery Program by stimulating desire for improvement of the home workshop, and financing under the Federal Housing Administration, a program is to be developed. This will be a joint effort of manufacturers of electric equipment for the kitchen and likewise those interested in non-electric furnishings. It is anticipated that local Electric Refrigeration Bureaus and Cookery Councils formed while those national programs were in motion may change their names to Kitchen Modernizing Bureaus and function for local tie-in with the national program. A local bureau would be the nucleus of an organization for the more expansive Kitchen Modernizing Bureau, with its numerous added industry groups.

A national committee of utility and manufacturer representatives is now in the process of formation and an announcement and details of a plan may be early expected.

BETTER HOUSING PROGRAM

Ruling on Permanent Connection

Among the list of items of electric equipment for which loans can be made to the home owner, and insured under FHA, are individual ranges, refrigerators, unit air conditioners, in addition to the built-in kitchen, permanently attached oil burners, ventilating fans and other equipment.

In answer to the inquiry for a legal ruling on what constitutes "permanent connection," information has been received from which the following is quoted: "The FHA has adopted a liberal attitude in passing upon these matters (equipment which is the part of the real property) and is given large discretion to the lending institutions. . . . Upon the question of plugged-in refrigerators, we feel constrained to rule that refrigerators which may be detached by pulling a plug out could not be considered as approved equipment. In other words, in order to come within the approved list the equipment must be attached to the wiring in such a way that if it were detached there would be some actual breaking or tearing from the permanent wiring system of the house."

Cable assembly for Permanently Attaching Refrigerator to Wiring System

Method used by Refrigerator Association of New York to bring installations under conditions for loans under National Housing Act

This interpretation applies also to electric ranges and the unit air conditioners, although unit air conditioners have also a plumbing connection.

In connection with the "permanent attachment" utility men will be interested in the junction box used by the Refrigerator Association of New York to bring the installation under conditions for loan under the National Housing Act.

"The leads from the refrigerator motor are connected and soldered to wires in a junction box—junction box attached on the exterior of the refrigerator or within the motor compartment. Attached to and running from the junction box is BX cable within which are the wires from the soldered connection of the junction box. At the other end of the BX cable is attached a regular BX elbow fitting which is in turn fastened to the outlet box plate by means of a lock washer. The leads now coming through the BX elbow box plate and lock nut are connected to the house service by means of a soldered connection."

There can be other connections for ranges and refrigerators equally acceptable. The important element is the "tearing" of a connection if the equipment is at any time removed.

Title II NHA Moves Forward

This long range program for new construction just announced provides a uniform basic interest rate to prospective owners to obtain financing for building a new home, or to owners of dwellings to re-finance their mortgages on more favorable terms. Title II provides for the mutual insurance of mortgages on these new dwellings or on existing dwellings, up to 80 per cent of appraised value, for an amount limited to $16,000, for periods up to twenty years. Privilege of payment by regular periodic instalments is given. Only dwellings designed for from one to four families will be eligible for insurance except under special conditions. In addition to the interest rate of 5 per cent a service charge of one-half of 1 per cent per annum may be made with mortgage insurance premium of one-half of 1 per cent per annum.

More complete details of Title II of the National Housing Act have been mailed to all commercial executives.

A PROGRAM FOR INCREASED COMMERCIAL LIGHTING

By JULIUS DANIELS

Chairman, Lighting Subcommittee, National Sales Committee, Edison Electric Institute

There is evidence on every hand that conditions make this a most opportune time to promote more adequate lighting in the offices and merchandising establishments of this country. For an encouraging period of time retail business has been increasingly favorable, not in restricted sections but throughout the entire country. Many of the leading industries of the country have prepared production schedules for 1935 well ahead of this year and the combined efforts of private business and government activity will necessarily bring renewed activity in office and merchandising outlet alike. The agricultural districts as well as the industrial are feeling the effect of new confidence and increasing incomes, and these factors are being translated into the sale of more merchandise and service.

More important even than the improvement in basic conditions is the receptive attitude of mind among business men today. They are more appreciative than ever before of the necessity of improving the efficiency of their own organizations. They know their objective, but are not definitely aware of the path to follow to attain it.

At a recent meeting of representative men in the lighting industry it was decided that now is a most opportune time to actively promote a campaign for better lighting in commercial establishments throughout the country. A program of this nature would incorporate plans for lighting retail establishments and office space of every description.

It is not sufficiently appreciated by many central stations that the ratio of selling expense to income from new revenue secured is lower in this class of business than for most others in which we are interested. It is to the interest of every utility company in the country to participate energetically in such a campaign.

An activity for better lighting conditions in commercial establishments offers an attractive increase in load to the industry. Many establishments have materially reduced their lighting load during the past depression. These can without doubt be brought to use higher standards of lighting. The lighting equipment of many interiors has become

MR. DANIELS

obsolete or out of keeping with the new types of decoration. These latter locations require new lighting units and, in many cases, additional wiring.

It has been proved repeatedly that any spasmodic attempt to increase business in our industry is unsound. Our efforts, therefore, must be directed over a reasonably long period to assure the permanency of the message we wish to convey. It seemed to the committee that a promotional sales activity of the scope contemplated must necessarily be continued for several years. The acceptance of better commercial lighting as a fundamental doctrine in the conduct of successful business enterprise is the goal we seek to achieve.

Through central station activity much has been done in certain communities already, but only as the result of continuous and effectively prepared programs. It is obvious that to enter upon a campaign of the sort which is believed will be effective, every central station must be adequately prepared to function within its own organization and with sufficient personnel. A continuing campaign necessarily requires a well-organized and thoroughly trained personnel with which to carry on promotional lighting activity permanently.

This calls for organization of a high order, for capable personnel, for management approval, and for the type of endeavor that will carry the movement to a successful conclusion.

With all these considerations in mind, plans are under way to prepare working material to completely cover all matters relating to the success of a commercial lighting campaign. There will be prepared under the sponsorship of the Edison Electric Institute and the Better Light-Better Sight Bureau an analysis of the sales opportunities open to central stations participating in commercial lighting promotional activities and an outline of the assistance which can be secured from other agencies. The best methods of organizing competent lighting departments will be presented along with methods to be pursued for the sale of good commercial lighting.

Included in the working material will be the results of tests made in the past, showing the value of good illumination in the different types of commercial endeavor, and the information recently made available on the subject of the Science of Seeing as applied to business activity. Methods will be presented for the simple solution of the usual lighting problems encountered and the types of lighting units to be selected for various purposes.

The Artistic Lighting Equipment Association, a national group made up of the leading manufacturers of commercial lighting equipment, is to be responsible for the preparation of additional material. This will serve as a guide for the fixture jobber and dealer in preparing his plans for cooperation in this drive. The jobbers and dealers embrace in their personnel some of the most capable commercial lighting salesmen, and their assistance will prove invaluable.

Commercial executives are urged to include in their 1935 program sufficient funds for proper publicity and for sufficient well-trained man power. The astonishing and gratifying results of the Better Light-Better Sight movement to date emphasizes the advantages of providing capable organization in lighting development. Results contributing to still further success may be expected by those who participate whole-heartedly in this commercial lighting program. The campaign is planned to start Jan. 1, 1935.

LEAD SHEATH INVESTIGATIONS IN CHICAGO*

By HERMAN HALPERIN

At the meeting of the Underground Systems Committee, N.E.L.A., on Oct. 5, 1932, I presented a progress report on lead sheath investigations entitled "Performance of 66-kv lead sheaths in service." This article is a second progress report on the general subject of sheaths, particularly on commercially pure lead, and the principal conclusions are as follows:

1. Incidental to improvements in thoroughness of impregnation of cables of the ordinary type, the sheaths on recently-made cables have higher internal pressures in service. The use of higher voltage cables with relatively large amounts of compound has further increased the sheath pressures.

2. Eighty-one per cent of the service troubles in Chicago due to defective sheath with 66 kv cable have occurred after the expiration of the two-year guarantee period.

3. The higher rate of failures of sheath to protect the insulation in 66 kv cable in Chicago than for other high voltage cable is entirely due to the large number of openings developing at defects in the sheath. Similar openings occur at the lower rates in the sheaths of lower voltage cable.

4. The sheath defects are usually due to the inclusion of non-metallic materials, principally oxides and sub-oxides, which are usually concentrated at the welds and tongues, resulting in imperfect welds.

5. In the future, a proportionately larger amount of the higher voltage cables will be used than in the past, indicating a growing need for perfect sheath structure.

6. Tests with the Sperry device show that local regions having high eccentricities may exist due in a large part to imperfect temperature control of the die block, indicating at least the possibilities of thicknesses below the specified minimum.

7. Sheaths having a uniform grain structure, that is, consisting of crystals of practically the same size, are generally stronger than sheaths having mixtures of large and small crystals, the data obtained to date indicating tentatively that a structure with only large crystals is the more desirable.

8. Considerable improvements have been made in sheaths as manufactured, and some of the sheaths made this year have uniform grain structure without visible welds or inclusions.

9. Bending tests of circumferential strips of sheath have been generally found to give reliable indications of the relative qualities of the sheaths. The type of break as well as the number of bends to break the sample is considered in these tests.

10. Based on microscopic examinations, cable sheaths may be separated into five classes. Experience indicates that sheaths of Classes 1 and 2 give little or no trouble in service, Class 3 sheaths may give trouble, while in those portions of cable lengths where the sheath falls into Classes 4 or 5 trouble is likely to occur in service.

Troubles With Cable Sheaths

The increase in troubles with cable sheaths during the past eight years has been due not to increased frequency of imperfections in the sheath but due to the increased demands on the sheath. The imperfections in sheaths made in earlier years received little notice for two main reasons: first, the insulation in the older cables contained considerable gas which was compressed when the cable was heated without creating very high internal pressures to cause sheath openings at defects; second, careful studies of the sheaths were usually not made and, hence, troubles due to defects were usually not recognized as such. In older cables impregnated with heavy compounds containing a large percentage of rosin, there have been splits or holes in the sheaths in service for years without failure where the cables were out of water.

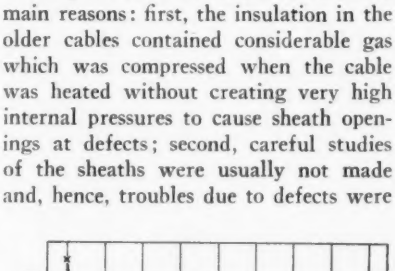


Fig. 1—Rate of Removal of 66 kv Cable in Chicago on Account of Failures

The improved operating records in recent years with reduced insulation thicknesses and higher operating voltages, which are shown in the annual reports on "Cable Operation," furnish adequate proof of the desirability of the changes that have been made in cable insulation. The rates of trouble due to the insulation in 66 kv cable in Chicago have decreased sharply; for the past year and a half no troubles have occurred (See Fig. 1). This is in sharp contrast to the increased rate of troubles due to sheath failures. Obviously, it is necessary to improve sheaths.

Since the temperature co-efficient of expansion for impregnating compounds is several times the co-efficient for the sheath the internal pressures incidental to heating are naturally the greatest in the highest voltage cables of the ordinary type. Therefore, it is to be expected that such cables with relatively large amounts of compound will have the highest rate of openings of the sheath at weaknesses in the structure. Since the use of cables at the higher voltages and at higher operating temperatures is increasing, the problem is becoming one of more general concern. For these reasons, most of the data discussed are for 66 kv cable in Chicago. Sheath troubles have also occurred on other cables including those operating at 115 and 4000 volts.

A comparison of the records for the past three years for the 66 kv cable with the records for all high voltage cable operated by the fourteen companies included in the studies of the Electrical Testing Laboratories, shows that the percentage of all operating troubles due to the failure of the sheath to protect the insulation are slightly higher for the 66 kv cable in Chicago than for high voltage cables in general; 85 per cent as compared on 75 per cent (See Table I).

The high percentage for 66 kv cable is due to more trouble with initially defective sheath, the rate being 7.56 sheath failures per 100 miles per year, or 59 per cent of all failures, as compared to only 0.66 per 100 miles per year, or 9 per cent of the failures, for all

*Presented at a Joint Meeting of the Transmission & Distribution Committee, E.E.I., the High Tension Cable Committee, A.E.I.C., and the Insulated Power Cable Engineering Association, at Chicago, Oct. 24, 1934.

TABLE 1—FAILURES AND REMOVALS DUE TO FAILURE OF THE SHEATH TO PROTECT THE INSULATION, 1931, 1932 AND 1933

Cause of Trouble	Failures per 100 Miles of Cable per Year: All H. V. Cable of 14 Companies	Failures per 100 Miles of Cable per Year: 66 kv Cable in Chicago
1. Initially defective sheath	0.66	7.56
2. Apparently good sheath cracked	0.09	0.61
3. External mechanical damage	1.69	1.59
4. Vibration, and wearing and bending due to cable movement	1.18	0
5. External heating or failure of adjacent cable	0.34	0.12
6. Corrosion	1.15	0.98
7. Moisture entering cable due to unclassified or unknown causes	0.42	0
Total	5.53	10.86
Per cent of all failures and removals	75.0	85.0

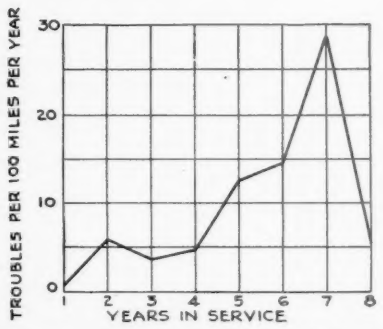


Fig. 2—Failures and Removals Due to Defective Sheaths of 66 kv Cable in Chicago

of the high-voltage cable considered. The rate of troubles due to external causes is generally low for the 66 kv cable because the installations are comparatively new and have embodied all recent improvements in construction design and workmanship.

The rates of failures and removals due to defective sheaths after various periods in service show that not many of the openings occur during the first two years of service, during which the manufacturer agrees to furnish new cable for that found to be defective (Fig. 2). The rates of troubles have been about 3.2 and 8.6 lengths per 100 miles of cable per year during the first two years and subsequent years, respectively; 81 per cent of the troubles have occurred after 2 years of service. The high rates of troubles for the 6th and 7th years of service are largely due to the prevalence of defective sheaths in the 1926 cable. Since much of this cable has been replaced the rate has dropped considerably for the 8th year of service. Nevertheless, the data do show an increasing rate of troubles during the first 5 years of service for the cable furnished up to 1930.

Openings through the sheaths are usually in the form of either longitudinal splits or circumferential laminations (Fig. 3). Such defects have been found on cables of all voltages, the example at the left of Fig. 3 being for a 4 kv cable. A longitudinal split occurs at the weld where the two streams of lead meet after flowing around the cable in the lead press when oxides or other inclusions prevent proper welding or the conditions of temperature and pressure are not right for perfect welding. Laminations or separations of the sheath into layers occur usually when two charges of lead meet under unsuitable conditions for good welding.

Other investigators have shown by short-time tensile tests that regions containing prominent welds are not weaker than other parts of the sheath. Professor H. F. Moore's work shows, however, that the results of short-time tensile tests cannot be used reliably to predict the long-time performance of sheaths. Also, the sheaths in service are not only subjected to tensile stress by internal pressure but also worked both longitudinally and radially as the cable expands and contracts. Furthermore, the welds and tongues are the locations at which nearly all of the troubles occur in service. Apparently, better workmanship in producing the radial and circumferential welds is necessary to improve the sheaths.

When defective sheaths are etched to bring out the grain structure and studied through the microscope, most of them

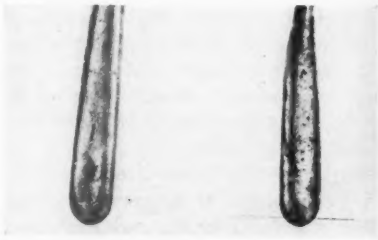


Fig. 5—Slugs of Lead After Oxygen Analysis Showing Inclusions as Dark Spots on Surface

Dross and Lamination in sheath of 4 kv cable

Split in Sheath of 66 kv cable

Fig. 3—Defects Found in Cable Sheaths

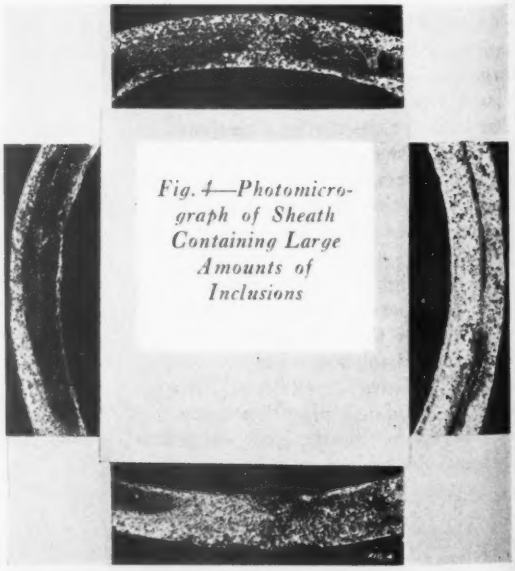


Fig. 4—Photomicrograph of Sheath Containing Large Amounts of Inclusions

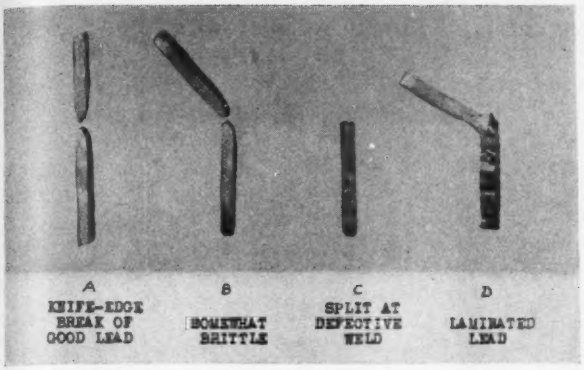


Fig. 6—Types of Breaker Obtained in Bending Tests of Lead

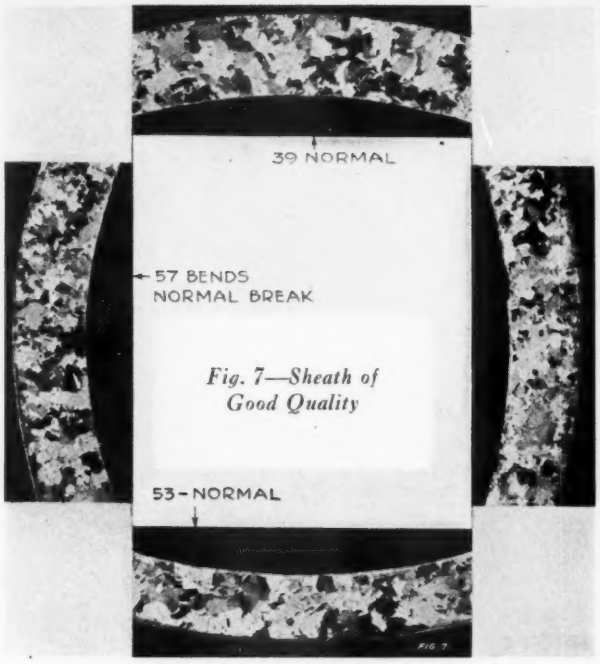


Fig. 7—Sheath of Good Quality

are found to contain non-metallic inclusions such as the dark regions shown in Fig. 4. That such regions do contain non-metallic inclusions has been shown by analysis for oxygen content. In two different sheaths, the weld regions where inclusions appeared to be most numerous were found to contain 2.6 and 12.7 times as much oxygen as other portions of the same sheaths. Not only were oxides more abundant but other foreign matter was present in unusual amounts, appearing as black spots on the slugs of lead from the weld regions after the oxygen analysis (Fig. 5).

Bending Tests on Strips of Lead

Microscopic study is one method of finding defects in the sheath. Another method, which is used, can be more readily applied because it requires no elaborate equipment. This method consists of bending a circumferential strip of the sheath back and forth until it breaks, counting the number of bends to fracture and noting the type of break produced. One bend is counted for each 90 degree movement and return to the straight position. Successive bends are made in opposite directions from the straight position. The tests were made at ½ inch intervals around the circumference on two adjacent strips. For future tests, ¼ inch intervals would be preferable, using either two or three adjacent strips. The bending may be done with the sample held in an ordinary vise or it may be done in a bending machine such as that devised by the I.P.C.E.A. Investigations indicate that the number of bends to break in the bending machine are about double the number in the vise and the reproducibility is slightly better. The sample should be at ordinary room temperature when the bending test is made. Some tests made in the field during winter weather gave misleading results.

Four types of break produced in such tests are as follows: (a) a normal break for good lead with necking down indicating ductile metal, (b) a brittle fracture in metal containing small amounts of scattered inclusions, (c) a crack at a defective weld along a longitudinal seam, and (d) a lamination or separation into layers through inclusions or at a defective weld between charges of lead in the lead press (Fig. 6).

Experience of the Commonwealth Edison Company over the past ten years, especially the rather larger experience of the past five years, has shown rather definite correlation between the number of bends to break the sheath in the bending test and the type of break with the quality of the sheath. Our experience indicates that if the number of bends in the vise to an initial break is three or less, the sheath is defective, if the number of bends is over six, the sheath is probably satisfactory, with the type of break influencing the decision as to quality.

Fig. 7 shows a photomicrograph of a sheath of good quality. The number of bends to fracture in the I.P.C.E.A. machine at various points around the circumference and the types of breaks produced are recorded opposite the points. Both the microscopic study and the bending tests show uniform structure.

In contrast, Fig. 8 shows an imperfect sheath in the same manner. Where the microscope reveals inclusions, the bending test shows also a low number of bends and an undesirable type of fracture. It appears that this simple method of test, consisting of bending a strip, is suitable to determine the approximate quality of the lead. To determine the cause for the defects and the detailed structure, the microscopic study appears to be necessary.

The sheaths on cables made in the last year or two appear to be considerably better in general than those made previously. Microscopic studies of 40 random samples of 9 makes of 1934 cable show that 38 per cent of the sheaths had visible welds and that some of the manufacturers are now usually producing welds of such perfection that no visible trace of the weld is left in the structure (Table II). This indicates the feasibility of producing sheaths without inclusions.

TABLE II—DATA ON VISIBLE WELDS IN SHEATH MADE IN 1934

Make	No. of Sheaths Examined	No. Having Visible Welds	Per Cent Having Visible Welds
A	4	0	0
B	1	0	0
C	7	1	14
D	3	1	33
E	5	2	40
F	8	4	50
G	6	3	50
H	5	3	60
I	1	1	100
Total	40	15	38

UNIFORMITY

Usually the defect found in cable sheath extends for only a few feet along the length, although some lengths removed from service have continuous defects for 25 to over 100 feet along the length. Perhaps the simplest means of

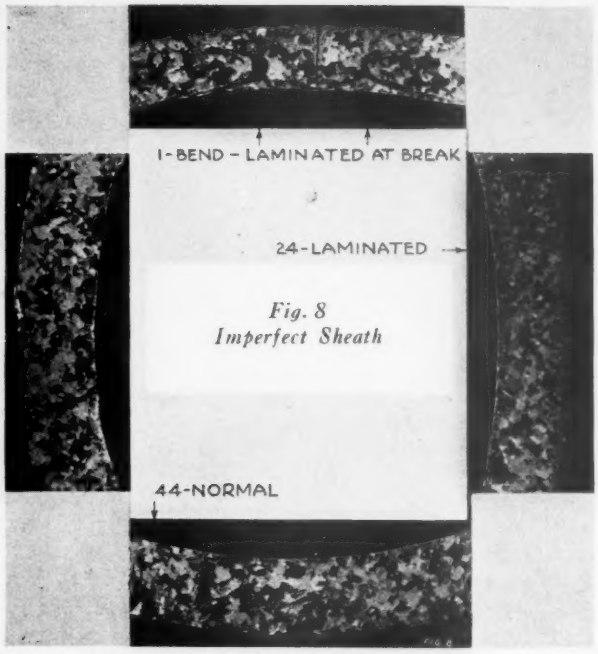


Fig. 8
Imperfect Sheath

Fig. 9—Sheath Having Small Grains
Gives Normal Type of Break in from 18 to 22 bends

illustrating this point is to use the data on eccentricities obtained by means of the Sperry testing apparatus. Although eccentric sheath is not a direct indication of defects of the types which have been previously discussed, high eccentricity is an indication of poor control of manufacture, indicating at least the presence of low lead thicknesses. Such eccentricity is apparently due in large part to lack of proper control of the temperature at the die block.

Tests with the Sperry device were made during the last year and a half on four orders for the Commonwealth Edison Company. The percentages of the lengths having eccentricities over 15 per cent in the sheath ranged from 7 to 100, as shown in Table III.

However, for the highest percentages, namely, 67 and 100, the amounts of cable having such eccentricities were only 0.6 and 3.2 per cent of the total cable lengths, respectively. In operation,

TABLE III—TESTS OF CABLE SHEATHS WITH SPERRY APPARATUS

Purchase order.....	1	2	3	4
No. of sections tested.	64	14	9	8
Cable having maximum eccentricity over 15 per cent				
Per cent of sections	55.0	7.0	67.0	100.0
Per cent of cable on order.....	4.5*	0.02*	0.6*	3.2

*Estimated figures; exact figures not readily available.

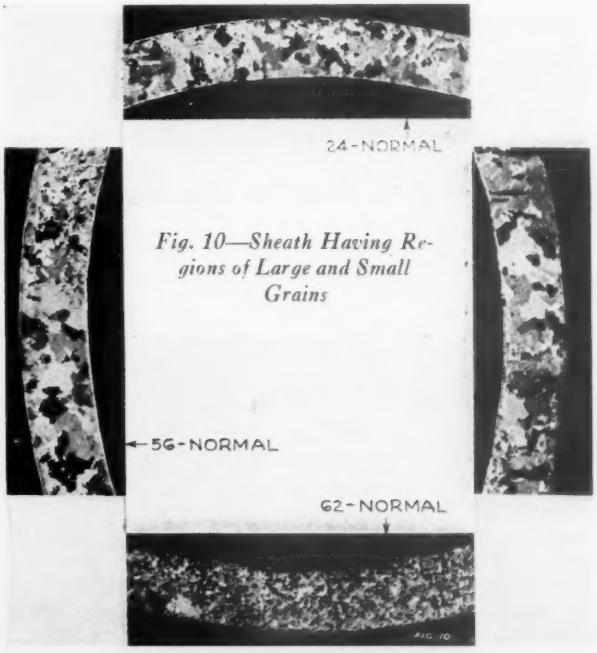


Fig. 10—Sheath Having Regions of Large and Small Grains

Fig. 11—Example of Sheath in Class 1
Definitely Good Sheath

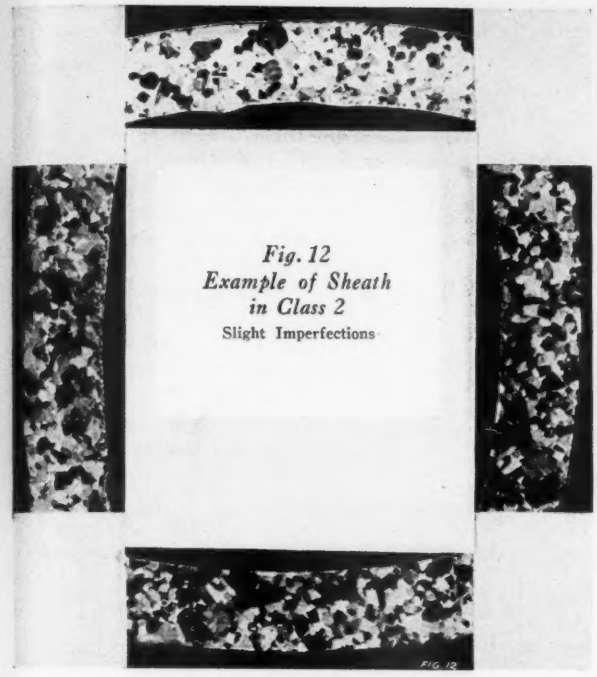


Fig. 12
Example of Sheath in Class 2
Slight Imperfections

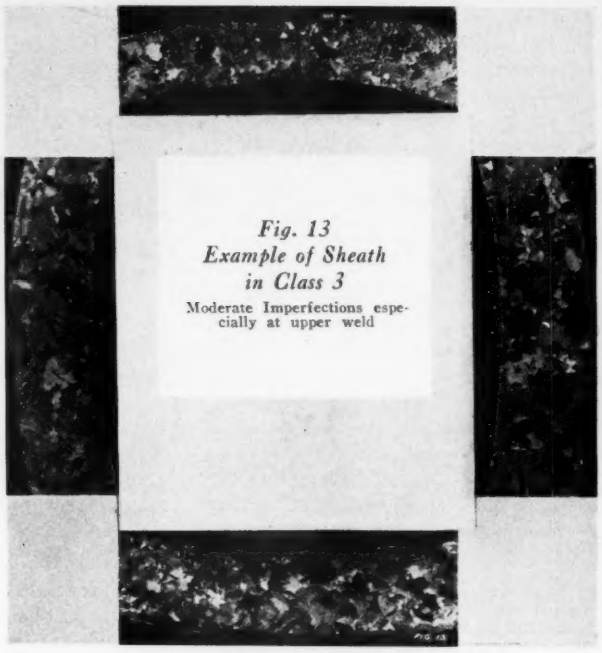


Fig. 13
Example of Sheath in Class 3
Moderate Imperfections especially at upper weld

defects involving only a foot or two of cable often cause removal from service of entire conduit lengths of cable. The percentage of lengths involved is therefore of more practical importance than the total length of the defects. Like a chain, a length of cable is no more serviceable than its weakest part.

Some cable sheaths have been found to contain rather uniformly small grains or crystals and others to contain rather uniformly large ones. No information has been obtained in the operating records as to the relative merits of large and small grains, since the troubles have focused attention on inclusions and similar defects. For a sheath having a small grain structure, the bending test showed good quality (Fig. 9). For the sheath illustrated in Fig. 10 which contained both large and small grains, the lead in the region of the large grains at the left broke in 56 bends in the I.P.C.E.A. machine. In the region of small grains at the bottom it broke in 62 bends, but in the region of intermixed large and small grains at the top, it broke in only 24 bends. Results of this type suggest that uniformity is desirable.

Grain Size

Table IV shows the relation of average size of grains to the number of bends

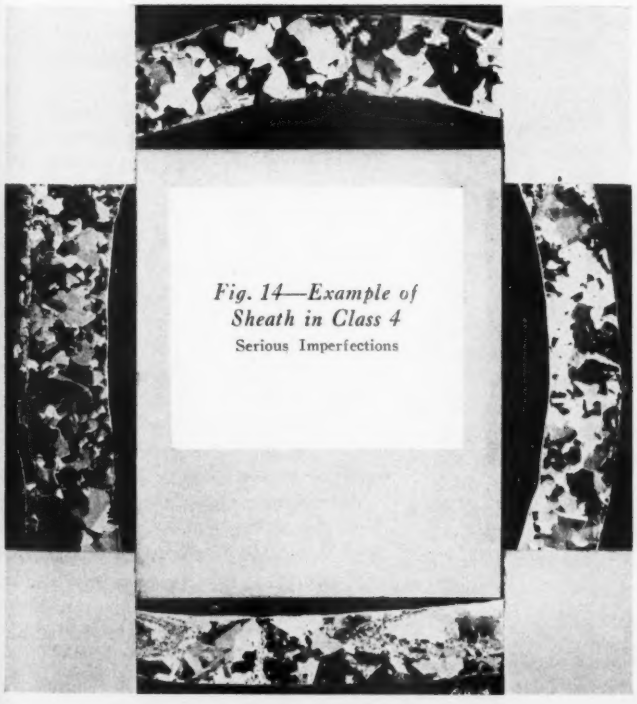


Fig. 14—Example of Sheath in Class 4
Serious Imperfections

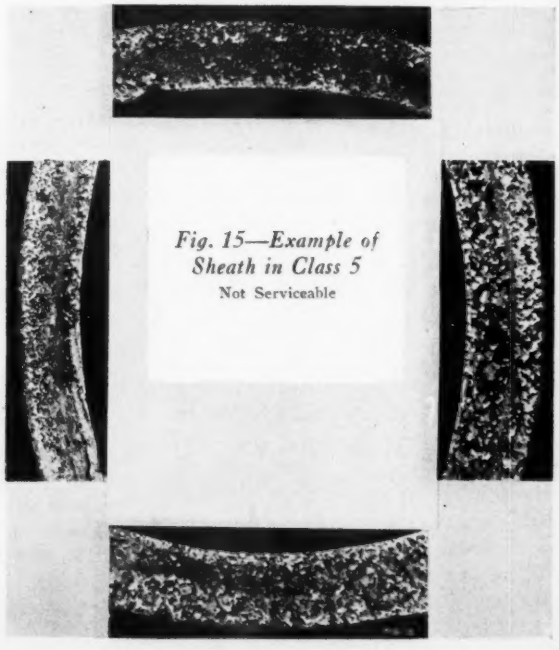


Fig. 15—Example of Sheath in Class 5
Not Serviceable

to break. In general, the samples having the largest grains require the greatest number of bends to break them. No investigation has been made in this connection to determine the reason for the difference in grain size in these samples.

TABLE IV—RELATION OF AVERAGE SIZE OF GRAINS IN LEAD SHEATHS TO NUMBER OF BENDS TO BREAK

Average Diameter of Grains—in	No. of Cases Breaking in Various No. of Bends in I. P. C. E. A. Machine 12 to 20	20 to 30	30 to 40	Over 40	Total
0 to 0.01	3	6	2	1	12
0.01 to 0.02	7	16	12	4	39
0.02 to 0.03	1	9	10	10	30
0.03 to 0.04	0	0	2	4	6
Total	11	31	26	19	87

Seventy per cent of the cases are between the diagonal lines.

Classification of Sheaths By Photomicrographs

In order to make practical applications of the results of the microscopic examinations, some method of classifying the results is needed. The desirable attributes of good sheath appear to be the following, in order of importance: (1) no non-metallic inclusions, (2) good welds, and (3) uniform grain structure. On this basis, examples of each of five tentative classifications have been selected. Class 1 is the best. These samples were chosen on the basis of the microscopic studies only. Later the results of the bending tests and operating experience were considered and were found to be in good agreement with the classification based on the microscopic studies.

For example, the sheath of Fig. 11 representing Class 1, or the best quality, is without visible welds, flowlines, or inclusions, and has uniform structure. Circumferential strips of this sample broke in from 28 to 41 bends in the I.P.C.E.A. machine with the normal type of fracture for good lead. Such sheaths do not cause trouble in service.

The sheath shown in Fig. 12 has a little less uniform structure with slight indications of a weld at the top, and inclusions near the surfaces. It illustrates class 2. The sample broke in from 36 to 44 bends with normal fractures. Probably this sheath would be satisfactory in service. However, since there are some deviations from perfection, there might be worse spots along the cable length.

Although this sample shown in Fig. 13 has in general lead of good structure, the prominent line through the weld suggests that a thin layer of oxides has been eaten out by the etching reagent. In the bending test from 25 to 52 bends with normal breaks were obtained, except in the regions of the weld which broke in 14 to 21 bends with blunt breaks. This case is placed in class 3 and is considered to be of questionable quality, especially for service on 66 kv cable.

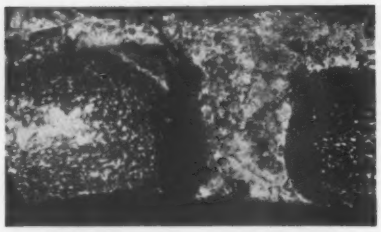


Fig. 16—Example of sheath in Class 5—Poor Weld that opened in service.

The sheath shown in Fig. 14 has rather pronounced inclusions of foreign materials at both the top and bottom welds and around the tongues visible in the bottom view. However, the inclusions were not deeply pitted by the etching reagent, which suggests that there were numerous small grains of lead among them. This does not show up well in the picture, but it was readily apparent under the microscope. The results of bending tests ranged from 10 bends at the lower weld to from 18 to 44 bends in other regions. Probably this sheath would cause trouble in service on 66 kv cable before the normal life of a good sheath had expired. This kind of sheath has been termed Class 4.

Fig. 15 shows an example of an obviously defective sheath. This sheath is not from a 66 kv cable, but from a 4 kv cable, which failed in service due to a sheath defect. Large areas of inclusions are apparent. The lead broke in the bending tests in the I.P.C.E.A. machine in from ½ to 12 bends, showing laminated structure. This type of sheath has been put in the lowest class, that is number 5.

Another example of Class 5 which resulted in a case of trouble in service is given in Fig. 4. It had not only pronounced inclusions, but had a lamination that is apparent in the left-hand side of the top view. Another type of defect that is placed in Class 5 is given in Fig. 16. The black area is principally the cavity left after non-metallic inclusions had been eaten out in the etching process.

The five classes in this tentative system of grading are:

1. Definitely good sheath.
2. Slight imperfections but probably serviceable.
3. Moderate imperfections which might or might not cause trouble in service.
4. Serious imperfections which would probably cause trouble in service, especially for 66 kv cable.
5. Definitely defective sheath.

Using this classification and these examples, an engineering assistant who is well versed in cable examination classified all the cases of trouble on all voltage cables due to sheath defects, by means of photomicrographs obtained for such cases, and obtained the excellent correlation that is shown in Table V. The one case of Class 3 quality which caused trouble was on a 66 kv cable, while the Classes 4 and 5 include trouble on lower voltage cables.

TABLE V—CLASSIFICATION BY PHOTOMICROGRAPHS OF SHEATHS WHICH CAUSED TROUBLE IN SERVICE

Class No.	No. of Sheath Troubles
1	0
2	0
3	1
4	5
5	14
Total	20

This system of classification has been applied to the 40 random samples of sheaths made in 1934, which were included in Table II. Fourteen, 16 and 11 of the sheaths were in Classes 1, 2, and 3, respectively, while 1 and 3, or 10 per cent of the total, were in Classes 4 and 5, respectively. In other words, 10 per cent of these 1934 sheaths sampled at random were of types which cause trouble in service.

The illustrations shown have been etched with ammonium molybdate, except the last one, where the etching was done with a weak nitric acid-acetic acid solution and with the sample connected to the positive pole of a dry cell. The latter method developed by Mr. C. A. Crawford of the Commonwealth Edison Company, had been found quite satisfactory since its adoption several years ago after a general investigation of 9 etching methods by this Company. The use of ammonium molybdate was adopted early last summer after the Company's second general investigation of existing methods of etching showed this chemical to have slight advantages over the electrolytic method. Both methods require only several minutes of etching. In general any etching method which will reveal impurities in the lead appears to be suitable for the purpose of establishing relative qualities, although the rating should be done by one who is familiar with the results obtainable by the method.

NOTES ON THE ENGINEEERING AND OPERATING FEATURES OF THE BRITISH GRID

An outline of the essential engineering and operating features of the British Grid, and of the position occupied by the Central Electricity Board, the Authority that administers the Grid.

The Central Electricity Board was established by the Electricity (Supply) Act of 1926; its powers and duties are prescribed therein. Its principal duty is to supply electricity in bulk to authorized undertakers; that is, to other bodies authorized by law to undertake the supply of electricity to ultimate consumers or others. The Board may not itself supply ultimate consumers directly, and it may not generate electricity except under special circumstances which seem not very likely to occur in practice. This principal duty of the Board, therefore, consists in buying electricity from those who generate it, and selling it to those who distribute at retail; these are often the same persons, but with respect to a substantial portion of the product they are different persons and facilities are therefore necessary for the transport of energy and to realize the economic benefits of interconnection; these facilities constitute the "Grid."

The Central Electricity Board consists of eight members appointed by the Minister of Transport for definite terms of office. The Board has provided itself with a head office staff and with district offices and staffs for the several "Areas" referred to above. The head office organization comprises a general manager, chief engineer, chief accountant and commercial manager with appropriate staffs, and the secretary and solicitor to the Board. For operating and administrative purposes all of Great Britain has been divided into ten "Areas," as shown in Figure 1.

Development of the Plan

The purposes of the Act of 1926 are carried forward in the following manner: A Scheme has been prepared for each of the areas shown in Figure 1 (except North Scotland) by the Board of Electricity Commissioners and forwarded to the Central Electricity Board for execution. These Schemes, possibly with some modifications to a final form, have been carried out, as to the construction of interconnecting lines and operation, by the Central Electricity Board with its own capital funds, for which it is accountable. The Board of Electricity Commissioners is a body created by the Electricity (Supply) Act of 1919, and has general oversight of the whole matter of electric power resources, but not administrative powers.

The Area Schemes, in general, besides providing for the interconnecting lines which are financed by the Central Electricity Board, also call for substantial changes in certain "selected" generating plants, such as the provision of new capacity in existing stations and entirely new stations, or the elimination of entire stations or parts thereof. These changes are financed by the owners of the plants and their agreement is therefore an important element in the formulation of the Area Schemes. The nine Area Schemes were adopted and published by the Board between 1928 and 1931.

The "Grid" itself, the interconnecting network of 132 kv and lower voltage lines, not only interconnects the local plants within the several areas, but also interconnects the areas. This has made the standardization of frequency an indispensable prerequisite to full operation and a great deal of conversion to the standard frequency of 50 cycles has been necessary, especially in Scotland and Northeast England. The cost of this operation has been considerable. The cost of construction of the Grid itself is given at £29,022,449; the costs borne by undertakers for the construction in generating stations is not available, but is obviously large. The additional expenditures due to frequency standardization have been £11,822,525 up to December 31, 1933; this sum is equal to 41 per cent of the cost of the Grid plant, and to a smaller but undoubtedly substantial proportion of all of the capital costs involved in the entire Grid Scheme.

Fig. 1—Outline Map Showing Area Schemes for British Grid

Ownership of Facilities

The Central Electricity Board owns and operates the main transmission system of 132 kv lines, a smaller secondary system of new 66 kv and lower voltage lines, the necessary switching and transformer stations, and protection and control circuits for the operation of these lines. It also owns transformer stations situated at generating stations for the transfer of energy to or from the lines, and transformer stations for simple one-way supply, at points supplied from the lines.

Generating stations connected to the Grid lines are owned by the local undertakers and oper-

TABLE I—SUMMARY OF GENERATING STATIONS CONNECTED WITH THE GRID—1933

	No.	Capacity Kw Present	Capacity Kw Ultimate	Output 1933 Millions Kwhr	Btu Kwhr
Selected Stations					
Base-Load					
Principal stations, to be enlarged and developed for base-load purposes	13	1,265,000	2,613,000	3,128	14,400
Other stations designed for base-load purposes	14	1,275,500	2,045,000	2,499	17,200
Smaller base-load stations, generally in outlying districts	5	155,075	356,070	179	18,400
All base-load	32	2,695,575	.....	5,806	16,900
Non-Base Load					
Principal large stations	14	908,625	1,015,600	2,101	17,600
Others, 30,000 kw and upward	26	1,194,525	1,061,375	1,845	20,700
" less than 30,000 kw	46	791,220	673,925	1,566	22,200
All non-base-load	86	2,894,370	.....	5,512	19,750
All steam stations	118	5,589,945	.....	11,318	17,700
Hydro, Waste Heat, etc.					
Hydro-electric	2	15,520	.....	64	.....
Waste heat, etc.	2	12,000	.....	21	.....
All hydro, waste heat, etc.	4	27,520	.....	85	.....
All Selected Stations	122	5,617,465	.....	11,403	.....
"Temporary Arrangements"					
Steam	34	576,735	.....	908	23,700
Hydro	2	24,120	.....	27	.....
Oil, Destructor, etc.	3	44,500	.....	36	.....
All "temporary arrangements"	39	645,355	.....	971	.....
All Generating Stations Connected on the Grid	161	6,262,820	.....	12,374	.....

ated by them with respect to the mechanics of operation, but subject to the Board's direction as to loading, output and availability of capacity. Other distributors of electricity taking from the lines of the Board own their own equipment within the low-tension terminals of the step-down transformers. All distribution plant is owned by the authorized undertakers for distribution in the system concerned.

Design

Essential features of design are dealt with briefly in the following paragraphs. Most of the official and professional publications relating to this Scheme have dealt with features of design in the electrical plant, and for that reason this part is only discussed here to the extent of giving some fundamental data. The steam-producing and mechanical plant has been much more meagerly dealt with in publications, so that the discussion here is necessarily restricted to the external features of the stations, as power units in the general scheme.

TABLE II—SUMMARY OF GENERATING STATIONS NOT CONNECTED WITH THE GRID—1933 (a)
Exclusive of North Scotland

Group	No.	Output 1933 Millions Kwhr	
(1) *Railway Supply:*			
L M & S Ry	5	148.7	
Southern Ry	1	124.3	
Gt. Western Ry.	4	21.4	
L N E Ry	4	12.9	
	14		307.
(2) *Tramways (b)*			
London Passenger Transport Bd.	3	780.7	
Glasgow Corpn Tramways	1	99.0	
	4		880.
Other Stations			
(3) 25 to 100 million kwhr/annum			
Steam	6	236.0	
Hydro, waste heat	10	96.0	
	16		332.
(4) 5 to 25 million kwhr/annum	46		341.
(5) Less than 5 million kwhr/annum	72		215.
Totals	152		2,075.

(a) As reported by the Electricity Commission—"Generation of Electricity in Great Britain Year Ending 31st December, 1933" June, 1934. Does not include private plants and certain non-statutory undertakings.

(b) These are the largest tramway systems reported separately. Other tramway supply stations are included in (3), (4) and (5). Also a part of the electricity generated in Grid stations is used for tramways.

Generating Stations

The development and improvement of economical generation has been based upon the designation of certain existing generating stations as "selected" stations where their present equipment and performance, their situation with respect to loads to be supplied or with respect to such facilities as fuel and fuel handling or condensing water, and other considerations, indicated their development as permanent units in the plan. These selections in many cases involved substantial changes in the stations, particularly in the elimination of small and inefficient machines, but left the stations as units in the position of having sufficient merit, in design or situation, to warrant development.

There are 122 "selected" generating stations attached to the lines of the Central Electricity Board, and 13 projected new stations. In addition, there are 39 generating stations designed as being under "temporary arrangements" which in

effect give them the status of selected stations during the carrying out of the works specified in the Scheme.

Table I gives the groupings according to size and the efficiency characteristics of the "selected" and other stations connected in the Grid system. These figures are for 1933 and for the situation of the Grid in that year. With respect to the larger stations, it is to be noted that some, which may ultimately be operated as base-load stations, do not yet contain their full complement of equipment, while other of the smaller or less efficient stations which would naturally be relegated to peak or stand-by service or completely shut down, may, at present, due to current and local exigencies, be operating otherwise. Nevertheless the table shows the state of affairs as it existed in 1933, with two areas—Central Scotland and Mid-East England—in full operation; four others—North-West England and North Wales, Central England, South-East England and East England—brought into full operation during the year or early in 1934, and the remaining areas—South Scotland, North-East England and South-West England and South Wales—approaching this condition.

There is a substantial amount of generating capacity and energy production which is at present independent of the Grid. This includes authorized undertakers who are qualified and who may eventually come within Grid supply, the larger traction and railway electrification enterprises, and certain non-statutory undertakings, but does not include private plants. Table II gives a compilation of these as reported by the Electricity Commission for the year 1933, in their annual report on Generation of Electricity in Great Britain. This same report gives the total electricity generated for the year as 14,964 millions kwhr. Of the total production other than that of non-statutory and private plants, it therefore appears that 2,075 millions of kwhr was generated independently of the Grid in 1933, or 13.8 per cent of the total.

The number of selected stations is rather large. Some of the selected stations are comparatively small and in other respects so situated that their value for the announced main purposes of the Grid Scheme are not immediately apparent; obviously this cannot be explained without full knowledge of the stand-by and peak load requirements. On the other hand, the proprietors of selected stations enjoy certain continuing advantages in trading with the Grid, as compared with simple "tariff" customers and it is reasonable to suppose that the status of a selected station may be eagerly sought.

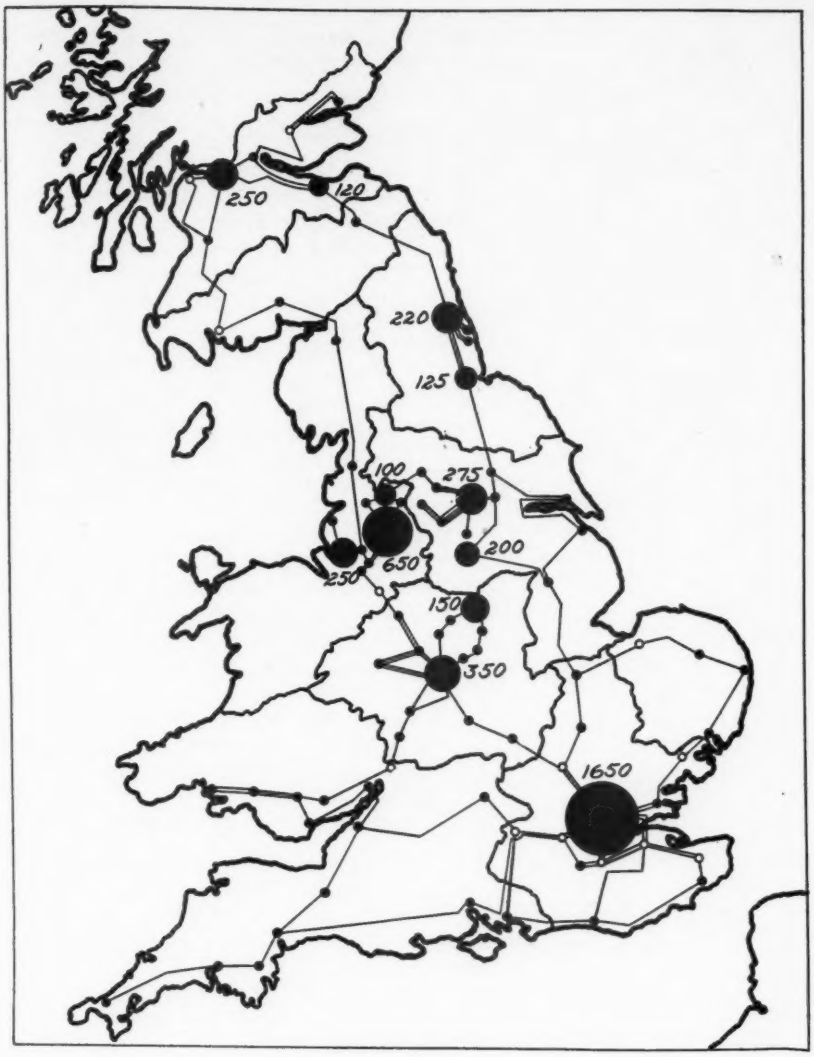


Fig. 2—Principal concentrations of generating capacity and interconnecting 132 kv lines on British Grid

Numerals contiguous to circles represent kilowatts of generating capacity

Interconnection

Characteristically, the selected and other large stations are concentrated in groups corresponding to the industrial areas and great centers of population. Smaller stations in lesser cities are connected with the lines, of course, but the outstanding feature of the transmission system, as such, is the relatively small line capacity connecting the major load centers. This is quite in accord with the plans of the Central Electricity Board, for it has been explicitly stated on a number of occasions, by various officials of the Board, that the Grid was not intended for the movement of large blocks of power over considerable distances. The map, Fig. 2, shows in a schematic way this relation between generating capacity and line capacity, for the conditions existing in 1933. Apparently this situation will become somewhat more, rather than less, marked with the progress of the whole scheme, since substantial increases in generating capacity are planned, but there do not appear to be any material changes in the main plan of the Grid lines.

The foregoing comments apply only to the interconnections between local areas of high density. Within these local areas there are many duplicate lines, ring feeders, lower-voltage ties and similar facilities for interconnection. While detailed circuit diagrams are available for many of these, it is not practicable to

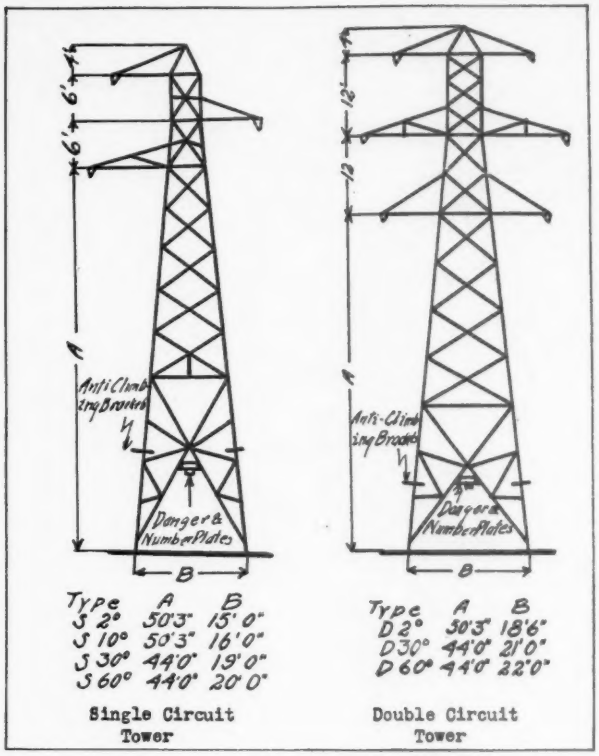


Fig. 3—Standard 132 kv line towers—single and double circuit

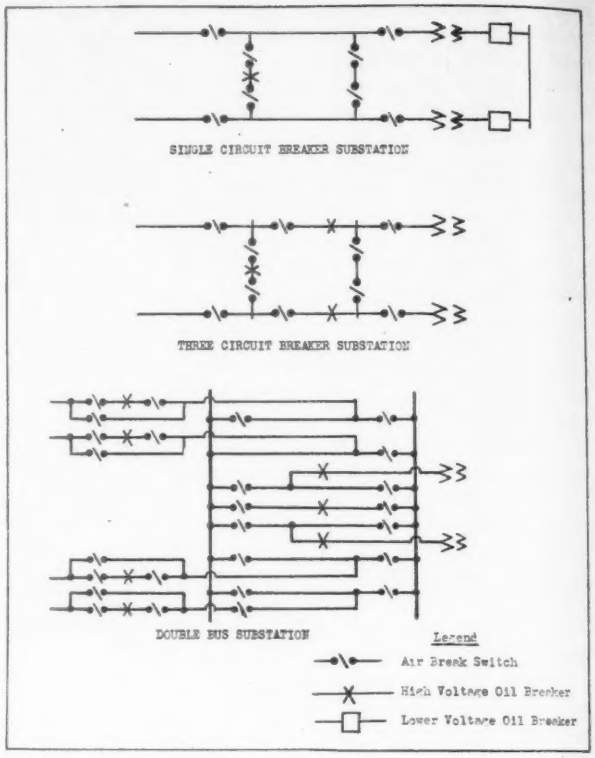


Fig. 4—Diagram of standard 132 kv substation layouts

discuss them in much detail in the absence of complete load data.

The nature of the loose-coupling of the Grid System was rather strikingly illustrated by an occurrence which led to an extensive shut-down in the London area on July 29th last. The exact nature of the original fault and the details of subsequent developments are only available through notices in the British and German technical press, and these are not very informative. The point to be observed is that due to these occurrences, whatever they were, with a comparatively small number of units turning, since it was a Sunday morning in summer, three of the Metropolitan stations went off the line and the remainder of the system in the Southeast and East areas either fell away or were cut away from the Grid lines, with considerable shut-down for several hours as a result. That is, the system fell apart as a loose-coupled system is expected to do; the accompanying shut-down may have been due to a deficiency in rolling reserve appropriate for this type of interconnection.

Lines

The basic high-voltage transmission network consists of overhead single circuit lines of 132 kv, capable in general of transmitting 50,000 kw with satisfactory regulation and efficiency for the distances involved. Double circuit lines are used where necessary and further provisions are made for possible future double-circuit lines. In the London metropolitan area a large amount of high voltage transmission cable is installed, some of 132 kv and much of 66 kv. Overhead lines of 66 kv are also employed occasionally under circumstances which make them essentially a part of the primary network although the design of the scheme contemplates the use of 66 kv as the highest of the voltages assigned to a "secondary" or subsidiary network.

The design of the 132 kv lines has been highly standardized as to towers, insulation, protection and switching and transformer stations. Certain departures from contemplated routes and even, in some cases, from standardized construction, have been necessary, but considering the density of population and the ancient systems of land tenure in Great Britain, the procurement of easements or other rights-of-way and the adherence to design standards seems to have been highly successful.

The 132 kv lines employ throughout an aluminum steel reenforced cable consisting of a core of 7 strands of galvanized steel wire each 0.11 in. diameter, surrounded by 30 strands of aluminum, also each 0.11 in. diameter; the overall diameter is 0.77 in. and the conductor conductivity is equivalent to a copper conductor of 0.175 sq. in. area. The overhead ground wire is of the same type, but has 7 steel and 12 aluminum strands, each 0.11 in. diameter. The standard single and double circuit towers are shown in Fig. 3. Further technical details such as the type of insulators used and the effects of fog or the atmosphere in industrial districts have been elaborately discussed in the technical press.

Sub-station designs have also been highly standardized. The details of design are beyond the scope of this article, but Fig. 4 shows one-line diagrams of the more simple types which are used wherever possible. The oil circuit-breakers for 132 kv are all rated for rupturing capacity of one-and-one-half million kv-a. Transformers for service with these out-door substations are of conventional design, the upper limit of size for three-phase units being governed by the necessity for transport, in some cases, away from railroads.

Supplementary to the main 132 kv. transmission network, the Grid System

comprises a substantial amount of subsidiary circuits at 66 kv. and 33 kv. and smaller amounts at still lower voltages, such as 22 kv., 11 kv. and 6600 volts. These lines are part of the transmission network owned and operated by the Central Electricity Board for the supply of the local systems connected to the Grid.

Although the 132 kv. transforming stations are standardized, are quite simple, and may even be a little over-simplified from the point of view of convenience or flexibility, according to American practice, so that "tapping the Grid" may be done at the smallest reasonable cost, there still has been some criticism of these costs from the standpoint, of course, of the users of the service. This situation might be expected to lead to an increasingly important role to be played by the "secondary Grid" namely, the network of 66 kv., 33 kv. and lower voltage lines. These secondary lines have been a definite part of the Grid plan from the beginning but they are not as extensively developed as the circumstances appear to warrant, if the cost of reaching the smaller distributors is actually an obstacle to development.

A good number of the larger undertakings connected to the Grid have local interconnections of their own of substantially the same voltages and transporting capacities as the Grid secondary lines. Some of these non-Grid networks and interconnections are fairly extensive, especially in the Midlands industrial areas, and in the Metropolitan area. The Central Electricity Board appears to have adequate statutory powers for the acquisition of lines necessary for its purposes, but on the other hand, the Act of 1926 itself makes detailed provisions for the supply of indirect takers through intermediaries and there is probably no technical reason why this arrangement should not be satisfactory.

The distinction may become important in a particular case because a local undertaker supplied directly from the Grid lines does not have to meet any direct charge for the line or the substation serving him. Of course, the capital and other charges do appear in the Grid tariff, and he shares these charges pro rata with all other takers within the area. On the other hand, a local undertaker supplied indirectly by another undertaker must meet directly the capital and other costs chargeable to the facilities which serve him, and, if these facilities are solely for his use, all of them, in addition to the Grid tariff.

Operation

Within the year the completion of the Grid has been announced. This refers to the physical completion of the primary transmission system as originally planned or as modified up to the time of the completion of the last tower of the then existing plan in September, 1933. The order in which the several sections of the structure have been constructed has been governed by local necessities, so that many portions of the Grid had been usefully in service for some time prior to the announcement of completion. The actual readiness of each area scheme of the Grid for its intended function as distinguished from the use of portions of it for local expediency, is fixed by the announcement of a "Grid Tariff" and the commencement of general trading within the area under this tariff. Following this, the full development of the contemplated loads depends upon the utilization of the benefits of the Grid by the various authorized undertakers engaged in the distribution and sale of electricity to ultimate consumers and, of course, upon the development of new loads.

The dates of the announcements of Grid tariffs and the commencement of general trading have been as follows:

Central Scotland	January 1, 1933
Southern Scotland ...	.....
North-East England..	.....
North-West England and North Wales	January 1, 1934
Mid-East England ...	January 1, 1933
Central England ..	January 1, 1934
South-East England and East England	*January 1, 1934
South-West England and South Wales	.....

(*) South-East England, containing the Metropolitan District, and East England, are operated as one Area.

Thus there are but two areas which have been in full operation for a complete calendar year.

When an area scheme is ready for regular operation and a tariff has been announced, authorized undertakers throughout the area may commence formal trading with the Central Electricity Board, either as owners of selected stations (who may be buyers or sellers or both), simple customers at the Grid Tariff, or customers not adjacent to Grid lines who may receive indirect supply. There are many of these latter who have been customers of other suppliers heretofore and their physical situation is unchanged except that they are now supplied with Grid electricity instead of the private product of their intermediaries. The prices paid for energy by these indirect consumers may be affected by this condition, as noted above, and there are statutory provisions governing contracts for such supply depending upon whether they were made prior to or since the Act of 1926. The possibilities of this situation are obvious, and it does not appear to be necessary to attempt an extended discussion of them here.

In practical operation, due to the relatively large number of selected stations, nearly all of the large or important systems enjoy the "selected" status. Notice should be taken of the circumstance that, although for the purposes of the Central Electricity Board it is the generating station that is selected, the actual effect for the owners of the selected station is to procure a selected system, since the electricity distributed by them to ultimate consumers will enjoy in due proportion whatever improvements there may be in final bus-bar costs, whether in their own stations or due to their connections with the Grid.

Trading

There are three principal methods of trading with the Central Electricity Board, namely, the methods open to owners of selected stations, simple purchase under the Grid Tariff, and indirect purchase and sale. Because it is the most fundamental of the methods and is a factor in both of the others, it is advantageous to consider the Grid Tariff first.

The Grid Tariff

The Grid Tariffs as announced for the several area schemes are given in Table III. The tariff consists of a three-part charge—service, demand and energy although, as shown in the table, the service charge under existing practical conditions is suppressed in effect, since there are few, if any, cases of multiple points of supply. Apparently points of supply are reckoned against selected stations rather than systems, that is, supplies to two or more selected stations of the same ownership are not considered to be multiple points of supply.

The demand part of the charge is fairly conventional in its principal features, which may be seen in the table; it will be noted that the incremental parts of the demand are large for small basic demands and small for large ones so that in the latter case the total demand charge consists substantially of the basic demand plus all in excess of that. On the other hand small systems must double or treble their basic demand in

order to enjoy the discounts in the upper brackets.

The demand charge contains a power factor clause which is all on the penalty side, there being no bonus provisions. It also contains another adjustment clause which may be novel to most Americans. This is the clause concerning "rates" or local taxes. As shown in the table, a standard figure is given for each area which represents the prevailing amount of the rates in that area. Provision is then made, in the same manner as the familiar coal clause, for a modification of the demand charge for deviations of the rates from the standard figure. The local taxation known as the "Rate" is based upon the gross annual rental or other profitable value of properties and is expressed as a certain amount in the pound of this annual value; thus properties such as generating stations in Mid-East England evidently have a typical "ratable value" of 5 shillings 3 pence in the pound. The energy charge is as shown in the table and contains a coal clause.

This Grid Tariff is the scale at which the Central Electricity Board expects to sell electricity to takers generally, and also, as will be shown, to owners of selected stations under a variety of conditions which appear to indicate that the tariff may enter extensively in many of these transactions in spite of the alternate methods available.

Selected Stations

The transactions of the owners of a selected station with the Central Electricity Board are governed primarily by certain provisions which may be tabulated as follows:

1. The entire output of a selected station must be sold to the Grid at a cost of production which is determined by a prescribed method.
2. The owners of the selected station are entitled to purchase their requirements for the supply of their undertaking by one of four principal methods, as follows:
   (a) Not to exceed the amount generated at the station; at the cost of production as in "1" adjusted for load factor and power factor and plus a charge for the expenses of the Grid.

   Or:

   (b) At the established area tariff, whichever is the lower.

   Or:

   (c) At the established area tariff in any case for requirements in excess of the amount generated at the station;
   (d) The cost of the supply to the owners may be adjusted so that it will not exceed the cost at which the owners could have supplied themselves, if they can prove that such costs would have been lower.
   (e) The owners and the Board may agree upon terms.
3. The owners of a selected station are under the obligation "to operate the station so as to generate such a quantity of electricity, at such rates of output, and at such times as the Board may direct" and to conduct such operations with due regard to economy and efficiency.

These provisions have been extensively discussed in British technical circles and their application to a variety of cases, either hypothetical or actual, have been shown. Apparently the range of possibilities is too wide to make such a discussion useful in this article. Supplementary notes upon the methods employed to arrive at certain of these costs

TABLE III—GRID TARIFFS

	Central Scotland Jan. 1, 1933	North West England and North Wales Jan. 1, 1934	Mid-East England Jan. 1, 1933	Central England Apr. 1, 1934	South East England and East England Jan. 1, 1934
Service Charge	For the first or single point of supply, no charge. For additional points of supply, according to the circumstances in each case.				
KW Charges	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
For basic demand (a) per kw.....	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0
For first increment (a) per kw.....	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0
For second increment per kw.....	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0
For all in excess per kw.....	2 15 0	2 15 0	2 15 0	2 15 0	2 15 0
Variations in kw charges:					
(a) For power factor: Increase of kw charge per 0.1 below 0.85 lagging, per kw.....	0 4 6	0 4 6	0 4 6	0 4 6	0 4 6
(b) For rates: Stated basic rates per kw of plant installed at selected stations	0 6 0	0 4 0	0 5 3	0 4 0	0 4 3
Variation of kw charge per 1 sh. variation from basic rates, per kw	0 1 10	0 1 10	0 1 10	0 1 10	0 1 10
Running Charges					
Per kwhr	0.200d.	0.200d.	0.186d.	0.196d.	0.210d.
Variation of running charges for fuel:					
Basic cost of fuel, per ton.....	0 13 6	0 15 0	0 13 0	0 12 0	0 16 0
Basic calorific value, b.t.u. lb.....	11,000	11,600	11,500	10,000	11,500
Variation of running charges, per 1d. Variation from basic cost of fuel at basic calorific value, per kwhr	0.001d.	0.0009d.	0.001d.	0.001d.	0.0008d.

(a) 1. Maximum demand in general is defined as the maximum kilowatts average demand for any half-hour during the months of November, December, January and February.
2. Basic demand is taken to be the above maximum demand for the calendar year preceding the year of account, and to be in no case less than 2000 kw.
3. Increments upon the basic demand vary with relation to the basic demand according to the following table of standard increments of demand.

Basic Demand	Increment	Basic Demand	Increment	Basic Demand	Increment
Not exceeding 3,000 kw	3,000 kw	9,000 + to 10,000 kw	2,300 kw	16,000 + to 17,000 kw	1,600 kw
3,000 + to 4,000 kw	2,900 "	10,000 + " 11,000 "	2,200 "	17,000 + " 18,000 "	1,500 "
4,000 + " 5,000 "	2,800 "	11,000 + " 12,000 "	2,100 "	18,000 + " 19,000 "	1,400 "
5,000 + " 6,000 "	2,700 "	12,000 + " 13,000 "	2,000 "	19,000 + " 20,000 "	1,300 "
6,000 + " 7,000 "	2,600 "	13,000 + " 14,000 "	1,900 "	20,000 + " 21,000 "	1,200 "
7,000 + " 8,000 "	2,500 "	14,000 + " 15,000 "	1,800 "	21,000 + " 22,000 "	1,100 "
8,000 + " 9,000 "	2,400 "	15,000 + " 16,000 "	1,700 "	22,000 and upward	1,000 "

are necessary, however, in order to understand their application.

Output of Selected Stations Purchased by Board

The cost of production of electricity generated at a selected station, which is the price paid for it by the Central Electricity Board to the owners unless otherwise by agreement, is determined in accordance with statutory provisions which are as follows:

a. Cost of fuel, oil, water and stores
   Salaries and wages, pensions, superannuation and insurance of employees
   Repairs and maintenance
   Renewals not chargeable to capital account
b. Rents, rates, taxes and insurance, except taxes on profits
c. Chargeable proportion of management and general establishment
d. Chargeable proportion of other expenses on revenue account
e. Interest on capital expenditures and on working capital
f. Allowance for depreciation.

All of the above to be attributable to the generating station concerned.

The cost of fuel includes handling and ash disposal. The bases for reckoning interest and depreciation are prescribed in the statute and differ between owners who are local authorities (or joint electricity authorities) and private companies. Interest, in the case of public authorities, is the average rate payable on money raised by the authority for the purpose at hand; in the case of companies it is the average rate of dividends and interest during the preceding year, but not less than 5 nor more than 6½ per cent. Depreciation allowance for public authorities is an amount equal to the sinking fund charges attributable to the plant; for private companies it is according to a Special Order.

Resale by Board to Owner of a Selected Station

The resale price charged by the board to the owners for the requirements of their undertaking is based upon the foregoing cost of production, but with important modifications. In the first place, it should be borne in mind that the board buys the output of a station, but resells for the requirements of a system. Since the owners cannot demand more at the resale price than the output of the station, the quantity resold at such price may be less, but cannot be more, than the amount generated by the station; additional requirements would be supplied "at the tariff." Therefore, although the output of a selected station is bought in bulk at the total cost of production in a single sum, the quantity resold aside from the added charges is "adjusted" for load-factor and power-factor, and into fixed and running components.

For resale, the separation of the supply items (a) of the cost of production is accomplished by formulae based upon load factor. The general effect of these formulae is to increase the fixed component as the load factor decreases. Typically, the proportions charged to the fixed component may be of the order of ⅛th of fuel, 1/6th of oil, waste and stores, 5/6ths of labor and 2/3rds of repairs, maintenance and renewals. The remainders of these quantities are, of course, charged to the running component. The "average monthly maximum demand" as used in the computation of the demand component, both for station and system demands, is actually an average of progressive monthly half-hour maxima. That is to say, a prior established monthly demand is taken for all successive months, until it is exceeded, throughout the year for which the reckoning is made.

From this point the adjusted fixed and running costs, and the final adjusted price are calculated.

1. The fixed component is calculated as follows:

$$\frac{\text{Station fixed costs} = \text{part of (a) and all of (b) to (f)}}{\text{Average demand on station}} = \text{Fixed costs per kw}$$

$$\text{(Fixed costs per kw)} \times \text{(Power factor adjustment)} \times \text{(Avg. demand of supply)} = \text{Total adjusted fixed cost}$$

2. The running component is calculated as follows:

$$\frac{\text{(Running component of (a))}}{\text{Total kwhr generated}} = \text{Unit running cost per kwhr}$$

$$\text{(Unit running cost per kwhr)} \times \text{kwhr supplied to system} = \text{Total adjusted running cost}$$

3. The final adjusted price for the supply to the owner's system is:

$$\text{(1)} + \text{(2)} + \text{Proportion of expenses of the board} = \text{Total price for supply}$$

The power-factor adjustment is effected by a coefficient which is computed from the power-factors of the station and of the load supplied, at the time of their respective maximum demands. More nearly, it is the ratio of the departure of these two power-factors from a standard power-factor of 0.8. This power-factor adjustment differs from the power-factor adjustment in the Grid Tariff first, in establishing 0.8 instead of 0.85 as standard; second, in providing for bonus and penalty, instead of penalty alone; and third, in exerting approximately one-half the money effect, per kw of demand for the same departures from standard power-factor, according to rough calculations for typical cases.

The expenses of the board are the chargeable proportions of its operation, management and general expense, but not expense incurred in the purchase or generation of electricity. For the Central Scotland and Mid-East England Areas, which were in full operation for the year 1933 the total price of energy sold by the Central Electricity Board was £3,651,432, and the expenses of the Board were:

Transmission expense, including cost of energy used in transmission	£117,889	
Local rates	7,781	
Management and general expense	48,712	£174,382

or: 4.8 per cent of the price of energy sold.

Indirect Supply

The Act of 1926 provides that the Central Electricity Board, when it begins general trading in an area, shall be under obligation to supply any authorized undertaker with his requirements, either directly or indirectly, subject to provision that, where the outlay for direct transmission is excessive with relation to the required supply, the Electricity Commissioners may, after hearing, permit the Board to impose terms and conditions, presumably as to capital outlay and contract, on the authorized undertaker who will receive the supply. It is further provided that the price to be charged to an indirect receiver shall be the price which the intermediate supplier pays, plus certain charges and allowances in respect of the transmission line, or proportionate part of it, used for providing the indirect supply. These charges and allowances are as follows:

(a) Cost of maintenance of transmission line and appurtenances
    Renewals thereof, not chargeable to capital account
(b) Rents, rates, taxes and insurance except taxes on profits
(c) Chargeable proportion of management and general establishment
(d) Cost of energy lost in transmission, between the suppliers' and the receivers' points of supply

(e) Other expenses on revenue account attributable to the operation

(f) Interest, (g) Depreciation — Same provision as in (e) and (f), items of cost of production for selected stations.

It is also provided that the foregoing shall not affect contracts made before the passing of the Act, that is, prior to Dec. 15, 1926.

Taking into account the actual total plant involved and its characteristics, and the various bases for trading in Grid energy, the situation appears to justify the prevailing trend of published professional comment in Great Britain. This is substantially to the effect that the amount of maneuvering room available to the board being quite limited, its principal problem consists in a discriminating distribution of benefits, or rather, in the avoidance of an undue concentration of savings in naturally well-endowed places. One commentator, having in mind the financial welfare of the board itself, suggested that the board might advantageously accumulate a kind of revolving fund of low-priced energy, by the purchase, on a non-Grid straight commercial basis, of an amount of hydro power. As a matter of fact, just such a procedure is provided for in the Act, with respect to waste heat, hydro, and surplus power generally, in the interest of over-all economies in the utilization of energy, and the board is actually receiving from privately owned hydro plants in North Wales, Lanarkshire and the Grampians, and will receive from another in Galloway upon its completion. None of these, however, are large enough to affect the main operations of the board in an important way.

So far as can be judged from the information at hand, the real source of these commentaries appears to be due to uncertainty as to the future course of the selected systems, particularly those which appear to lack ideal qualifications for this status, from the point of view of the economy of the over-all scheme. The possibilities are much too complicated for discussion at the present stage of development. It is more profitable to study what actually has occurred in the two areas which have been in full operation for the entire calendar year of 1933.

Central Scotland and Mid-East England Operations in 1933

The Central Scotland and Mid-East England Area Schemes have been in full operation for the calendar year 1933, the "Grid Tariffs" for these areas having been published Jan. 1, 1933. The total amount of electricity generated in Great Britain in that year, by authorized undertakers, railway and tramway authorities and non-statutory undertakings as reported by the Electricity Commissioners was 14,964 millions of kilowatt-hours.

The generation of electricity in the two areas under consideration by all of the kinds of producers mentioned above, for the same year, was:

	Stations	Kwhr Generated Millions
Central Scotland	19	1,067
Mid-East England	42	1,568
Total	61	2,635

For the same period, the reports of the Central Electricity Board give the following general statistics for the production of electricity in these two areas under the Grid Scheme, that is to say, by selected stations and stations with which temporary arrangements had been made:

	Selected Stations	Temporary Arrangements	Selected Stations Capacity in Commission	Millions Kwhr Generated
Central Scotland	9	2	489,995 kw	934
Mid-East England	16	5	702,000	1,562
Total	25	7	1,191,993	2,496

Details of the station operations with respect to capacity, loading and efficiency are given in Table IV, wherein it will be seen that the bulk of the output was produced by the best available stations, from the point of view of thermal efficiency, but that the load-factors of these stations were not remarkably high, taken as a whole.

An attempt has been made in Table V to indicate the sources of supply of electricity sold to ultimate consumers by the local distributors, that is to say, whether by direct supply from the Grid, indirect supply, local production or otherwise. The best official statistical sources are not yet available for the year 1933, and in any event these data require adjustment to the calendar year. Available sources in the trade press and elsewhere have been utilized and the result is probably good enough for the purpose, since the object is merely to indicate the relative proportions in which the various available methods of supply were utilized in this first year of full Grid operation.

The table is self-explanatory. Some inconsistencies, which may be noted especially in the lower subdivisions, are due in part to actual inconsistencies in the conditions of supply, which were, however, of such minor nature that it would unduly complicate the table and this discussion to take full account of them. For example, certain districts on the borders of the areas are supplied indirectly from neighboring area schemes, and it is not yet very clear as to where this supply will be accounted for. However, it is not very important either, because the principal interest is in the manner in which the greater part of the supply is handled.

The financial data relating directly to these two Area Schemes for operations in 1933, as published by the Central Electricity Board, appeared in the October, 1934, number of EDISON ELECTRIC INSTITUTE BULLETIN, on page 339. It is reprinted at the foot of this column for convenience.

Detailed financial reports for the operations of stations and authorized undertakers for the year 1933 are not yet at hand, and it is therefore not possible at this time, to carry the financial figures down into detailed operations for individual undertakings.

Tables IV and V show that the bulk of the electricity generated and distributed was produced at the larger and more efficient stations in accordance with basic plans and that the amount produced under extremely uneconomic conditions was negligible in the total.

INCOME STATEMENT—CENTRAL SCOTLAND AND MID-EAST ENGLAND AREAS—1933

Revenues from sale of energy		£3,651,432
Cost of Energy Purchased		3,517,230
		£134,202
Operating Expenses:		
Operation, maintenance and miscellaneous	£71,187	
Local taxes	7,782	
Proportion of management and general expense	48,711	
Total		£127,680
Operating income		£6,522

TABLE IV—ELECTRICITY GENERATED BY STATUTORY UNDERTAKINGS IN THE CENTRAL SCOTLAND AND MID-EAST ENGLAND "GRID" AREAS—YEAR 1933

Source	No. of Stations	Capacity Kw	Generated 1933 Millions Kw	Btu/Kwhr Avg.
Sources Connected with the Grid:				
Base Load Stations	9	615,250	1,603	15,800
Other Selected Stations	14	476,675	583	20,000
All selected steam stations	23	1,091,925	2,186	16,900
"Temporary Arrangements" Steam Stations	5	96,375	185	24,100
All Grid Steam Stations	28	1,188,300	2,371	17,500
Hydro Selected Stations	2	15,520	64	.....
Waste Heat Selected Stations	1	12,000	19	.....
Temporary Arrangements, Destructor Plants	2	42,000	35	.....
All Grid Stations	33	1,257,820	2,489	.....
Sources Not Connected with the Grid:				
Steam Stations	8	.....	121	22,800
LM&S and L&NE Rys (Steam and Oil)	2	.....	9	.....
Other small stations (mixed)	15	.....	7	.....
All non-Grid Stations	25	.....	137	.....
Total Generated in the C.S. and M.E.E. Areas	58	.....	2,626	.....

TABLE V—SOURCES OF ELECTRICITY DISTRIBUTED TO ULTIMATE CONSUMERS—CENTRAL SCOTLAND AND MID-EAST ENGLAND "GRID" AREAS—YEAR 1933

	Number of Undertakings	Number of Consumers (a)	Consumer's Connected (a) Load—Kw	Kwhr Sold (b) Millions
(1) *CEB Direct Supply to:*				
(a) Selected Stations	18	644,864	1,800,095	1,760
(b) "Temporary Arrangements" Stations	5	58,379	149,757	95
(c) On Tariff	6	21,087	44,472	22
Total Direct Supply	29	724,330	1,994,324	1,877
(2) *CEB Indirect Supply through:*				
(a) Yorkshire Electric Power Co.	18	35,303	135,460	94
(b) Clyde Valley Electric Power Co.	6	27,642	84,361	56
(c) Scottish Central Electric Power Co.	5	3,068	7,232	6
(d) Local authorities	12	24,177	41,217	20
Total Indirect Supply	41	90,190	268,270	176
(3) Mixed, Local Generation and purchase	10	12,500	19,800	13
(4) Generated Independently	9	17,916	38,202	22
(5) Bulk Supply from Non-Grid, Non-Statutory sources (c)	4	10,466	7,200	9
Total Accounted For	93	855,402	2,327,796	2,097

(a) Derived from "'Electrician' Annual Tables of Electricity Undertakings—1934"
(b) Approximate; estimated from various sources
(c) From collieries, steel-works, etc.

Two comments are suggested by the tabular data, one concerning the status of the "temporary arrangement" stations and the other the situation that may come about among the smaller distributors as to the choice between direct and indirect supply.

From the available information, the position of "temporary arrangements" stations is not entirely clear. Such stations appear to enjoy for the present the advantages available to selected stations so far as the quality of the station enables it to command these advantages. Judged solely on the basis of reported thermal efficiency, they are not in fact very good stations. They can hardly be indispensable for peak load purposes in view of the large number of smaller selected stations and their uses. Their inclusion in the power pool can hardly fail to increase the cost of grid electricity. It is not clear whether technical necessities, operating exigencies, or expediency caused their inclusion on a status so near to that of the selected stations. The same speculations are provoked by some of the poorer selected stations. These matters will be more clearly revealed when the results of two or three more years of full operation are reported.

Concerning the smaller distributors, it would seem to be a reasonable expectation that such small enterprises would be ideally served by direct connection "at the Tariff" to the Grid system. This would appear to be the Grid's most important reason for existing but, on the contrary, it appears that only six out of 93 distributors in these two areas of the "Grid" system, representing about 2 per cent of consumption, are served in this manner. Of the remainder 46 are selected stations, and the 41 that are not selected stations are served indirectly, that is, through the facilities of other, usually the larger, distributors.—A. M.

(Bibliography on page 384)

PRIME MOVERS COMMITTEE MEETING

ALFRED IDDLES, *Chairman*

The first meeting of the Prime Movers Committee since its reorganization and enlargement as authorized for the current administrative year was held at the Edgewater Beach Hotel in Chicago on Oct. 22 and 23 under the chairmanship of Mr. Alfred Iddles. The meeting was well attended, the only absentees being those members who are located at great distances or those who were prevented from attending by specific and unforeseen circumstances.

This committee under its scope, has oversight of all technical questions relating to power production except hydraulic power. Its concern is therefore with a very great diversity of equipment in the steam-raising plant, the engines for final application of power to electric generators, and the auxiliaries and appurtenances thereto, as well as fuels, lubricants and water supply. By reason of the variety and number of individual equipments and the circumstance that these are assembled into complete power plants no one of which is exactly like any other, the accumulation and exchange of actual field experiences has a value that is greater, perhaps, than in any other technical department of the industry. This is reflected in the procedure of the committee where a premium is placed upon actual experience that is applicable to similar, but not precisely identical situations in other places.

A large part of the time of this meeting, as in former meetings of the predecessor committee, was devoted to round table discussions along the lines described above. These same considerations have given value in the past to reports of encyclopaedic type and somewhat voluminous contents, rendered necessary by the requirement that a representative cross-section of practice must be given to make such reports useful. At the present meeting it was agreed that, owing to the small volume of construction in recent years, many reports that would ordinarily be useful may be deferred, to be brought up later as circumstances warrant.

An important part of the committee meeting was devoted to a resume of the present situation of the industry with respect to capacity, and the rate at which existing excess capacity may be taken up with increased loading as this may occur due to increased industrial activity. In particular the problems relating to the superimposition of high pressure units on old stations were discussed in this connection.

Other matters discussed included the treatment of feed-water and cooling water, the rehabilitation of condensers, metallurgical developments in connection with the use of metals at high temperatures and the disposal of fly-ash. It was agreed that in the absence of unforeseen developments three meetings in the year would be sufficient for the business now before the committee. The next meeting will be held in February at a place to be selected.

ELECTRICAL EQUIPMENT COMMITTEE MEETING

W. F. SIMS, *Chairman*

The fall meeting of the Electrical Equipment Committee was held at the Edgewater Beach Hotel, Chicago, on October 25 and 26. Practically the entire committee was present for the meeting, and a number of visitors were present at the open sessions of the meeting.

The committee, with W. F. Sims, Chairman, and J. O'R. Coleman, Secretary, is organized into four divisions, and the personnel of the committee is assigned to these divisions as follows:

Apparatus and Design Division

H. W. Eales, *Chairman*	George Sutherland
R. A. Hentz	A. H. Sweetnam
J. Allen Johnson	R. W. Wilbraham
E. R. Stauffacher	E. C. Williams

H. B. Wood

Operating and Maintenance Division

E. S. Fields, *Chairman*	H. S. Fitch
Paul P. Ashworth	E. S. Fitz
A. E. Bettis	E. E. George
R. N. Conwell	Basil Lanphier

System Engineering Division

S. M. Dean, *Chairman*	L. J. Moore
M. T. Crawford	Philip Sporn
E. W. Dillard	Stanley Stokes

L. M. Smith

Utilization and Watthour Meter Division

J. F. Fairman, *Chairman*	J. E. Sheehan
J. H. Foote	Wm. Shuler
S. J. Lisberger	A. E. Silver

H. L. Wallau

The Utilization and Watthour Meter Division presented the report on Energy Diversion which has just been published.* The discussion of this report showed that this problem is of major importance at the present time, and that considerable attention should be given to it by all utilities. In addition, this division is studying the problem of further standardization of meters, the standardization of service entrance devices, and the problems associated with the use of cable service entrances. In the utilization field the division is planning to study the problems connected with the application of electric ranges to various types of systems, the problems associated with the installation of air conditioning equipment, and the use of power factor correction capacitors which have resulted in some cases of resonance of certain system harmonics.

The Apparatus and Design group presented a draft of a report on the prevention of insulating oil fires. This report was reviewed and approved by the committee. This division is continuing its studies of oil circuit breaker rating, rectifier development, apparatus and system troubles. A new study on the modernization of old equipment is being undertaken. At the present time the possibility of modernizing, by minor changes, equipment which has been out of service before it is returned to service, appears to hold considerable promise of substantial economies and improvement in system design and operation.

The System Engineering Division is continuing its work on wave shape of electrical equipment, and the studies of load and frequency control. Mr. Dean presented a draft of a general report on Grounding, and this draft will be distributed to all members of the committee for a careful review. Studies will be initiated on firm rating of various parts of a system, system rehabilitation, system characteristics as affecting circuit breaker rating, interconnection contracts in relation to systems interconnected at many points.

Mr. Fields, Chairman of the new Operating and Maintenance Division, presented a report on Operating Experience with Reclosing Breaker Circuits. This report supplements the report presented last year, and concludes committee study on this subject. The division is planning studies of the following items: Frequency

* E.E.I. Publication No. B 10.

of Inspection; Testing and Overhauling of Equipment; Care of Idle Equipment; Parts of Equipment that would Cause Removal from Service Although No Failure Occurs; Cleaning of Rotating Apparatus; Carrier Current and Pilot Wire Relaying Systems; Operating Experience and Testing of Bushings; Reconditioning of Insulating Oil.

Mr. Lawton outlined the plans for keeping in contact with engineers engaged in electric supply and manufacturing in foreign countries. The committee has established correspondence with about twenty-five leading engineers in other countries in order to obtain information on their practice. When information is required on any subject a request for this information will be made to the foreign correspondents, accompanied by a brief statement of the practice in this country on this particular subject.

At the invitation of the Chairman, representatives of the Allis-Chalmers Company, the General Electric Company and the Westinghouse Electric and Manufacturing Company outlined the recent developments by their companies.

Mr. Nichols, of Allis-Chalmers, described the automatic feeder voltage regulator and the explosion port oil circuit breaker which had recently been developed. He also described the new circuit breaker testing laboratory.

Mr. Summerhayes, of the General Electric Company, mentioned the following among the General Electric Company's recent developments: New Demand Meter with Cumulative Dial; Recording Telemeters for Steam Turbines; Thyratron (Power Tubes) Developments, including the following, Small General Purpose Rectifiers—15 to 100 kw, 250 v, larger Rectifiers—150 to 450 kw, 250 v, Static Frequency Changer, 300 kw, 60 cycle, 2,300 v to 25 5/7 cycles, 220 v, Thyratron Motor—400 hp, 625 rpm, 2,300 v, Mercury Arc Rectifiers —Tank Type; Pyranol Capacitors; Feeder Voltage Regulators, including large 3-Phase Step Regulators—Type MLT-18, small Single-Phase Step Regulators for Branch Feeders, Branch Feeder Induction Regulators for 2,400 v Circuits up to 100 amperes and 4,800 v Circuits up to 50 amperes, the 1-Step Booster for Branch Feeders; Type "L" Pyranol Bushings; Safe Harbor Largest Single Phase Waterwheel Generator—25,000 kw, 13,300 v, 25 cycles; PM-13 Automatic Oscillograph; Carrier Current Developments, Low Frequency Carrier Current System to Control Street Lighting and Domestic Off-Peak Water Heating; Relay Developments; Lightning Arresters; Switchgear Developments, New Indicating Lamps and Control Switches, New Lines of Knife Disconnecting Switches, New Line of Air Circuit Breakers, FK-144 Oil Circuit Breaker, Impulse Oil Circuit Breaker—138-230 kv, 3-cycles; Cascade Type Potential Transformers for Grounded Neutral Systems; the FP-19 Oil Circuit Recloser.

Mr. Hanker of the Westinghouse Electric & Manufacturing Company mentioned the new 183,300 kv-a steam-driven turbine, and the 82,500 kv-a waterwheel turbine, which are now under construction. The construction of these large generators presented many new problems and required extensive development work. As a result of these developments which Mr. Hanker described, he stated that this company was prepared to build 250,000 kv-a 1,800 rpm, 62,500 kv-a 3,600 rpm steam-driven units, and slow-speed units up to 150,000 kv-a. He also described the progress in insulation of transformers, and development in switchgear, which has resulted in much faster operation of oil circuit breakers.

The new form of committee organization, with the membership assigned to particular divisions of work within the scope of the committee, was observed to work well. The time of the members is conserved in the preparation of subjects, but all of the subjects dealt with are ultimately reviewed by the entire committee. In this way it is possible to conduct and supervise all subjects that are useful and appropriate for committee consideration, and at the same time keep committee activities closely controlled in the interests of economy.

The committee tentatively agreed that the next meeting would be held early in February in Cincinnati.

TRANSMISSION AND DISTRIBUTION COMMITTEE MEETING

MARK ELDREDGE, *Chairman*

The first meeting of the Transmission and Distribution Committee E. E. I. for the current administrative year was held at the Edgewater Beach Hotel, Chicago, Oct. 22-24, inclusive. The committee has recently been expanded from a membership of 18 to approximately 40.

At the first session of the meeting, held the morning of Monday, Oct. 22, reports were submitted on Weatherproof Wire Specifications, by D. W. Roper, on Marking and Lighting of Airways, by P. H. Chase, and on Plant Coordination, by W. F. Davidson. Regular committee business was transacted during this session and a discussion was held on new subjects which the committee might wish to take under consideration.

The afternoon of Oct. 22 was given over to reports and brief discussions on subjects relating to Overhead Distribution, with Merrill DeMerit, Chairman of the Overhead Distribution Section, presiding. Reports were given on the following subjects:

Bare Wire for Secondaries and Primaries
Economies of Distribution
Primary Fuses and Cutouts
Grounding
Lightning Protection Practice
Loading and Strength of Overhead Lines
Outages on Distribution Lines
Pine Pole Treating Specifications
Pole Life Records
Depth of Pole Settings
Stringing Sags and Tensions
Transformer Impedance and Losses
Railroad-Wire Crossing Specifications

At the close of this session, a demonstration of lamp flicker was given by engineers of the Commonwealth Edison Company. The demonstration included an explanation of the lamp flicker problem. The demonstration proper consisted of staged flicker tests with varying frequency of flicker and voltage dips. Forms were distributed to those present who were requested to observe and record the conditions under which variations in voltage became observable and objectionable.

The forenoon session on Oct. 23rd was a round table discussion with representatives of manufacturers and others present. C. T. Sinclair presented the AC Network Operating Report which covered the years 1932 and 1933, and which was a sequel to the 1931 report. The following papers, illustrated with lantern slides, were also presented:

New General Electric Network Protector —by D. K. Blake
A New Type of Network Protector—by W. R. Bullard
Manhole Covers—by W. F. Davidson, for J. F. Fairman.

In the afternoon a joint session was held with the High Tension Cable Committee of the A. E. I. C. and the Insulated Power Cable Engineers Association, with Mr. Sinclair presiding. In addition to the presentation of the Cable Operation Report by W. F. Davidson for H. R. Searing, the following papers were presented:

Vertical Riser Cables—New York and Duquesne Light Company Experience—by W. F. Davidson, for H. R. Searing

IPCEA Review of Developments in Lead Sheath Manufacturing—by T. F. Peterson

Lead Under Stress—by R. W. Atkinson

Cooperative AEIC—IPCEA Lead Test Methods—by W. F. Davidson and I. T. Faucett.

The last session of the meeting was held on the forenoon of Oct. 24th, with Mr. Sinclair presiding. This was also a joint meeting with the same groups which participated in the meeting held the previous afternoon, together with the Electrical Insulation Committee of the National Research Council. The program for this session included a report on Lead Sheath Investigation in Chicago, by Herman Halperin. This was followed by an interesting paper and report by Prof. H. F. Moore, of the University of Illinois, on the Strength of Lead Sheath; IPCEA General Discussion on Non-Metallic Duct Cable, by S. J. Rosch; and New York and Brooklyn Tests at Higher Operating Temperatures Including the Thinner Walls of Insulation, by W. F. Davidson; Micro-examination of Lead, by W. F. Davidson; and the Sperry Tester Experience, by A. N. Lawrence.

The afternoon of Oct. 24th was left free for inspection trips relating to lead sheaths, to the cable factory, lead press room and laboratories at the Hawthorne Works of the Western Electric Company and the Central Service Building of the Commonwealth Edison Company. The inspection trip to the Western Electric Company afforded an opportunity to examine microscopic studies, observe vibration tests, witness a lead press in operation and an examination of calcium lead sheath. For the visit to the Commonwealth Edison Company Laboratories, arrangements had been made for the microscopic study of lead, observations of bending tests of cable in a dummy manhole, and an exhibit of lead samples of corrosion tests.

After the committee meetings several members attended the remaining sessions of the Electrical Insulation Committee of the National Research Council, held at the University of Illinois, Urbana, on Oct. 25th, 26th and 27th.

The 'Little Red'

In this one-room cottage at Saranac Lake, N. Y., called "Little Red," the modern treatment of tuberculosis began in 1885 because Dr. E. L. Trudeau discovered the value of rest in curing tuberculosis » » Progress has been made in the fight against tuberculosis, but it still kills more persons between 15 and 45 than any other disease » » Help conquer it by using Christmas Seals on your holiday letters and packages.

The National, State *and* Local Tuberculosis Associations *of the* United States

BUY CHRISTMAS SEALS

NORTHWEST ASSOCIATION ACTIVITIES

By BERKELEY SNOW

Organization of the Engineering & Operation Section and the Business Development Section of the Northwest Electric Light & Power Association has been effected within recent weeks. Each section held its first Executive Committee meeting of the new year, setting up a tentative program and plan for the annual section meeting to be held in the spring of 1935.

The engineers met in Seattle Sept. 21 and 22 at the call of W. S. Hill, Grays Harbor Railway & Light Company, chairman. The section is again organized in four major committees with chairmen as follows: Production and Generation, J. E. Yates, Pacific Power & Light Company; Transmission and Distribution, T. A. Purton, Idaho Power Company; Utilization, P. P. Ashworth, Utah Power & Light Company; General Committee, J. B. Fisken, The Washington Water Power Company.

Operating problems will again engage the principal attention of the Production and Generation and Transmission and Distribution Committees. Utilization Committee will study problems under four sub-committee chairmen as follows: Utilization Devices, Walter Brenton, Portland General Electric Company; Meters, L. D. Snow, Puget Sound Power & Light Company; Illumination, F. H. Murphy, Portland General Electric Company; Wiring, S. B. Clark, Northwestern Electric Company. The General Committee is broken down into the following three sub-committees: Power Systems Engineering, G. E. Quinan, Puget Sound Power & Light Company; Code, H. H. Schoolfield, Pacific Power & Light Company; Accident Prevention, J. D. Ellis, Northwestern Electric Company.

A plan for publishing reports from month to month in *Electrical West* as fast as they are ready for publication will be worked out. These reports and others will be fully discussed at the spring meeting, which is tentatively scheduled to be held in May, 1935, at a place to be determined. Joe Hellenthal, Puget Sound Power & Light Company, is vice-chairman of the section.

The Business Development Section Advisory Council met in Portland Oct. 12 with Tom D. Fulford, Puget Sound Power & Light Company, section chairman. The section will again be organized into three bureaus: Residential Sales, Glenn L. Jackson, The California Oregon Power Company, chairman; Industrial and Commercial Sales, Carl L. Hoffman, The Washington Water Power Company, chairman; Rural Sales, C. J. Hurd, Mountain States Power Company, chairman.

Vancouver, B. C., was selected as the place of the annual meeting and the time tentatively set in February, 1935. The keynote of the meeting, as established by the Advisory Council, is to be "practical plans and methods of adding load in each of the three departments of the business covered by the three bureaus." Most of the reports presented will tell the actual experiences of companies who have made an outstanding success in adding load of certain types, rather than the composite theory of committee members. Use will be made of talking pictures and skits to dramatize the business building possibilities in the fields covered.

R. M. Bleak, Utah Power & Light Company, is section vice-chairman.

POWER SALES ITEMS

AIR CONDITIONING

"Action Needed for Promotion of Summer Air Conditioning," by W. S. Walker. Gas-Age Record, October 6, 1934, p. 289. Robbins Publishing Company, Inc., 9 East Thirty-eighth Street, New York City.

It is now essential that the management of every gas company give serious consideration to a policy concerning the promotion of summer air-conditioning equipment.

"New Type Cooling Plant for Cafeterias." Refrigerating Engineering, October, 1934, p. 194. American Society of Refrigerating Engineers, 37 West Thirty-ninth Street, New York City, Publishers.

Cooling plant which overcomes limitations of small space and changes air three to four times per hour.

DIESEL ENGINES

"Power Generation by Diesel Engines." Power Plant Engineering, October, 1934, pp. 462-467. Technical Publishing Company, 53 West Jackson Boulevard, Chicago, Ill. New York Office, 171 Madison Avenue.

This article gives the advantages, disadvantages and problems commonly met in the operation of Diesel engines and should prove of interest as a matter of general information.

"Operating and Maintaining Diesel Engines," by Geoffrey Porter. Power, September, 1934, pp. 522-523. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

This article should be read by all power engineers who have to combat Diesel engine competition. It points out the principal causes of Diesel engine operating troubles and shows the necessity of competent operators.

ELECTRIC DRIVE

"Connecting the Motor and Load," by Robert Drake. Power, September, 1934, pp. 490-492. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

In this article the author discusses various types of drives and their proper application.

"Economical Factory Drives," by C. W. Falls. Electrical World, September 29, 1934, pp. 30-31. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

The economies of group and individual drive for any plant should be determined by an analysis of each plant. This article gives an outline of such an analysis.

ELECTRIC MOTORS

"Synchro-Ties to Handle Torques of Motor Magnitudes," by C. W. Drake. Electrical World, August 25, 1934, pp. 240-243. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

The synchro-tie principle, also called Selsyn, was first used only for duplicating meter indications, a matter of small torques. Because industrial engineers appear a bit slow to realize that the principle knows no torque limits, the author was asked to show how to figure the requirements for linking mechanisms of any size in synchronism, or in coordinated position. In this article is a fundamental approach to applications of all types.

"Largest of Cranes a Triumph in Coordinated Power," by R. W. Monroe. Electrical World, August 11, 1934, pp. 182-184.

A complete description is given of a 350 ton hammerhead crane equipped with 425 horsepower in motors used by the Navy Department at the Puget Sound Navy Yard.

"Hydraulic Coupling Saves 27 per cent on Forced-draft Fan Power." Power, July, 1934, pp. 398-399. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

Although this article does not deal directly with a power sales problem, it does describe a new method of speed control using a constant speed motor.

ELECTRIC OVENS

"Enamel Baking by Induction Is Developing Rapidly," by Edgar L. Bailey. Electrical World, August 18, 1934, pp. 212-213. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

Experience with induction ovens totaling 600 kilowatts in capacity for use in baking enamel on automobile parts is described.

ICE PLANTS

"Ice Plant Modernizes to Increase Profits." Ice and Refrigeration, August, 1934, pp. 59-60. Nickerson & Collins Company, 435 North Waller Avenue, Chicago, Illinois, Publishers. New York Office, 520 Singer Building.

Illustrated description of improvements made in City Ice Company plant, Pine Bluff, Ark.—steam equipment replaced by electric power—descriptions of electrical equipment—tank room enlarged—condensing system—operating figures from plant log show greatly decreased costs.

INDUSTRIAL ELECTRIFICATION

"Controls That Aid Production," by George H. Hall. Electrical World, October 27, 1934, pp. 26-28. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

All industry is interested in electrification as the tool to aid in economy and manufacture. Electrical engineers and power sales engineers are the agents to apply electricity to industry. They need to be up to date. This article follows a series that gives information on motors and controls available for industry. Motor characteristics may be modified greatly by the use of modern control—almost anything may be done to fit a motor to production requirements. Essential elements of control available for safety, for meeting duty requirements and for securing best operation are outlined in this article. It contains information that can be applied for industrial electrification.

INTERCHANGE

"Basis for Interchange Practice." Electrical World, October 27, 1934, pp. 29 and 64. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

Light thrown on interconnection practices that frequently arouse queries in commission hearings. What items are included in increment costs that determine charges for interchange power and how determined? What unit line-loss and maintenance expenses are deductible? When shall excess demands be carried on primary valve and when on secondary valve? Who shall protect or back up interchange power? Who shall handle and charge for energy transferred across a system? New England decisions are discussed.

POWER FACTOR

"Makes Power Factor Correction Pay," by J. W. Nash. Electrical World, October 13, 1934, p. 623. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

How a large industrial plant tackled poor power factor as an element of diverse production economy and results obtained.

REFRIGERATION

"Refrigeration by Steam Jet," by D. W. Morgan. Power, September, 1934, pp. 506-507. McGraw-Hill Publishing Company, Inc., 330 West Forty-second Street, New York City.

A short discussion of the efficiency of refrigeration by steam jet, together with a few operating costs comparing refrigeration with steam jet as against Freon compression.

STANDARDS

"NEMA Motor and Generator Standards, 1934." 1934 NEMA DC and AC Motor and Generator Standards. Refrigerating Engineering, October, 1934, p. 206. American Society of Refrigerating Engineers, 37 West Thirty-ninth Street, New York City, Publishers.

STEAM PLANTS

"Steam vs. Electricity in Meat Packing Plants." National Provisioner, October 6, 1934, p. 23. National Provisioner, Inc., 407 South Dearborn Street, Chicago, Ill., Publishers.

Large packing company gives detail of steam and power situation. Claims that it "is now making both steam and power—and burning no more fuel than before power equipment was installed."

WELDING

"A New Timer for Resistance Welding," by R. N. Stoddard. Electrical Engineering, October, 1934, p. 136. American Institute of Electrical Engineers, 33 West Thirty-ninth Street, New York City, Publishers.

The "ignitron" type of tube is applied for obtaining precise control of the welding current.

OPERATING COMMITTEE

Commercial Programs Approved—Wiring Installations Survey—Scope of Accident Prevention Committee

Among the actions of the Operating Committee, at its meeting held at the general office of the Institute on Oct. 25, was the approval of a request from the Chairman of the Sales Committee, Mr. H. P. J. Steinmetz, for appropriations to contribute toward the financing of a number of commercial activities during 1935. The funds appropriated were for the furtherance of the Better Light-Better Sight Program, the Electric Table Cookery Program, the Electric Water Systems Program and the Kitchen Modernization Program, appropriation for the latter being contingent upon adequate financial support from the manufacturers. (These programs are discussed by Mr. C. E. Greenwood in an article in this issue.)

President McCarter presided at the meeting. In discussing his plans for the ensuing year, Mr. McCarter stated that he contemplated trips to different sections of the country in the interest of the Institute. Managing Director Weadock presented a report on committee and general office activities, and upon the status of the uniform classification of accounts, noting the actions taken by the public utility commissions of several states to set up their own systems of accounting.

In reporting for the Codes and Standards Committee, its Chairman, Mr. A. H. Kehoe, explained the conditions surrounding the regulations governing interior wiring and requested approval by the Operating Committee of the program now being carried on by the Codes and Standards Committee and the representatives of the Electric Light and Power Group on the Electrical Committee, N.F.P.A. He also requested an appropriation to carry out a survey of wiring installations and to employ the services of a man to explain the program of the electric light and power group to other parties interested in electric regulations for interior wiring. Upon motion by Mr. Kehoe, seconded by Mr. E. W. Lloyd, the following resolution was carried unanimously.

RESOLVED, that the Operating Committee instructs its Code and Standards Committee and its representatives on the Electrical Committee, of the National Fire Protection Association, to seek a greater measure of inter-industry accord in settling the differences now existing within the present committee.

The Operating Committee further recommends that efforts be concentrated on securing approval of rules permitting the use of the grounded concentric system of residential wiring that has been on trial in various states to the extent of a thousand or more installations in homes.

The Operating Committee is further of the opinion that the importance of accomplishing this end is of great advantage to the consumer and the public in general and to our industry in its present necessity of promoting increased residential consumption.

RESOLVED FURTHER, that the sum of $5,000 be appropriated for the use of the representatives of the Institute in procuring a field survey of bare neutral installations and for the services of a temporary employee to explain the purposes of the Electric Light and Power Group to inspectors and others interested in electric regulations for interior wiring.

(Subsequently arrangements have been made with the Underwriters Laboratories, Inc., to conduct a survey of wiring installations, and the services of Mr. James S. Mahan have been retained for field work in connection with the general wiring program of the electric utilities.)

Upon the written recommendation of Mr. W. A. Buchanan, Chairman of the newly organized Accident Prevention Committee, the scope of that committee was proposed and approved as follows:

"The prevention of accidents in the Electric Light and Power Industry.

"To arrange for assembling of information relating to accidents.

"To formulate procedure and recommend methods for the control of accidents and of the general health and fitness of employees.

"To obtain analyses and submit them to interested groups in the Edison Electric Institute.

"To coordinate these activities with those conducted by other organizations."

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CONVENTIONS AND MEETINGS

NOVEMBER

12-15 National Association of Railroad and Utilities Commissioners, Willard Hotel, Washington, D. C.

DECEMBER

3-4 National Industrial Council, Waldorf-Astoria Hotel, New York, N. Y.

3-8 Eleventh National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, N. Y.

3-8 American Society of Mechanical Engineers, New York, N. Y.

JANUARY

10-12 American Engineering Council, Washington, D. C.

22-25 American Institute of Electrical Engineers, New York, N. Y.

BIBLIOGRAPHY

(*For British Grid article, page* 371)

For official sources, the Annual Reports of the Electricity Commissioners: Electricity Commission Annual Reports on Electricity Supply, 1932-1933 and 1933-1934; the Electricity Commission Annual Reports on Generation of Electricity in Great Britain, year ending December 31st, 1933. Annual reports of the Central Electricity Board, 1928-1933 inclusive.

For general statistical information, the "Electrician" Annual Tables of Electricity Undertakings, 1933 and 1934; Garke's Manual of Electrical Undertakings, 1933 and 1934; "Electrical Times" Electrical Supply Tables of Costs and Records.

For technical information, line and substation design, "Construction of the Grid Transmission System in Great Britain," by Johnstone Wright and C. W. Marshall, "Journal of Institution of Electrical Engineers" Vol. 67, No. 390 of June 1929; and "The Lower Voltage Sections of the British Grid System" by C. W. Marshall, "Journal of Institution of Electrical Engineers" Vol. 74, No. 446, February 1934.

For the computation of production costs and trading under the Grid Tariffs, "The Costing of Production at Selected Stations" by Norman C. Bridges, "Journal of the Institution of Electrical Engineers," January 1934, page 37.

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